

AD-A250 061



ARI Research Note 92-25

①

Development of a Methodology for Collective Training Decision Making in Army Units

J. Thomas Roth

Applied Science Associates, Inc.

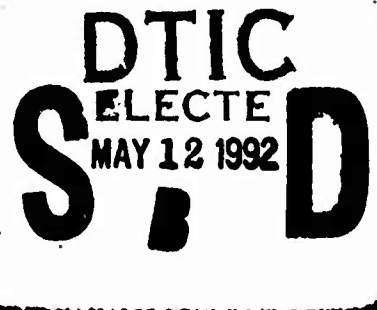
for

**Contracting Officer's Representative
James H. Banks**

**Field Unit at Presidio of Monterey
Howard H. McFann, Chief**

**Training Systems Research Division
Jack H. Hiller, Director**

April 1992



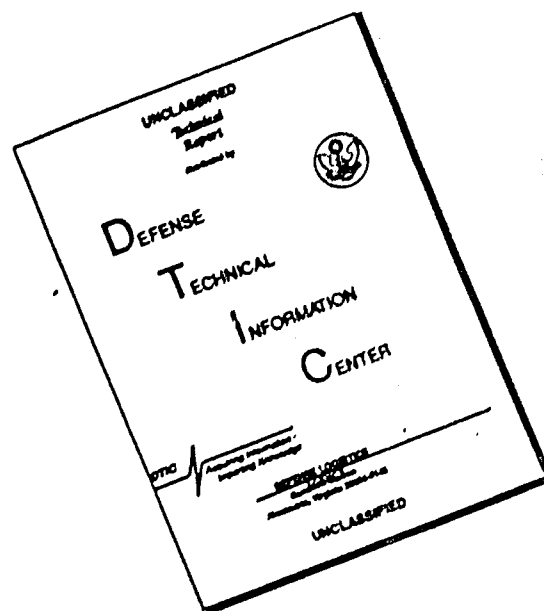
**United States Army
Research Institute for the Behavioral and Social Sciences**

Approved for public release; distribution is unlimited.

92-12419

92 5 08 010

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

**A Field Operating Agency Under the Jurisdiction
of the Deputy Chief of Staff for Personnel**

EDGAR M. JOHNSON
Technical Director

MICHAEL D. SHALER
COL, AR
Commanding

**Research accomplished under contract
for the Department of the Army**

Applied Science Associates, Inc.

Technical review by

James H. Banks

NOTICES

DISTRIBUTION: This report has been cleared for release to the Defense Technical Information Center (DTIC) to comply with regulatory requirements. It has been given no primary distribution other than to DTIC and will be available only through DTIC or the National Technical Information Service (NTIS).

FINAL DISPOSITION: This report may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The views, opinions, and findings in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE 1992, April	3. REPORT TYPE AND DATES COVERED Final Report Nov 88 - Jul 91		
4. TITLE AND SUBTITLE Development of a Methodology for Collective Training Decision Making in Army Units		5. FUNDING NUMBERS MDA903-89-C-0019 62785A 791 3401 C01		
6. AUTHOR(S) Roth, J. Thomas		8. PERFORMING ORGANIZATION REPORT NUMBER --		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Applied Science Associates, Inc. P.O. Box 1072 Butler, PA 16003-1072		10. SPONSORING/MONITORING AGENCY REPORT NUMBER ARI Research Note 92-25		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences Training Systems Research Division, ATTN: PERI-I 5001 Eisenhower Avenue Alexandria, VA 22333-5600		11. SUPPLEMENTARY NOTES Contracting Officer's Representative, James H. Banks		
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.		12b. DISTRIBUTION CODE --		
13. ABSTRACT (Maximum 200 words) For this research, regression equations to predict performance change for unit collective tasks were developed from subject matter expert (SME) estimates of performance under various conditions. Equations for tasks performed by five Infantry and Armor unit types and a conceptual model process for making collective training decisions were developed. Researchers developed, applied, and validated categorization schemes for identifying the likely effects of time without training and turn-over in unit membership. User guidance for identifying collective training needs, developing training strategies to satisfy the needs, and selecting appropriate training modes for unit training was developed from the other products of the research.				
14. SUBJECT TERMS Unit performance Collective tasks Training decision support Collective task Turnover Army personnel management performance Skill retention			15. NUMBER OF PAGES 277	
			16. PRICE CODE --	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT Unlimited	

GENERAL INSTRUCTIONS FOR COMPLETING SF 298

The Report Documentation Page (RDP) is used in announcing and cataloging reports. It is important that this information be consistent with the rest of the report, particularly the cover and title page. Instructions for filling in each block of the form follow. It is important to **stay within the lines** to meet **optical scanning requirements**.

Block 1. Agency Use Only (Leave blank)

Block 2. Report Date. Full publication date including day, month, and year, if available (e.g. 1 Jan 88). Must cite at least the year.

Block 3. Type of Report and Dates Covered. State whether report is interim, final, etc. If applicable, enter inclusive report dates (e.g. 10 Jun 87 - 30 Jun 88).

Block 4. Title and Subtitle. A title is taken from the part of the report that provides the most meaningful and complete information. When a report is prepared in more than one volume, repeat the primary title, add volume number, and include subtitle for the specific volume. On classified documents enter the title classification in parentheses.

Block 5. Funding Numbers. To include contract and grant numbers; may include program element number(s), project number(s), task number(s), and work unit number(s). Use the following labels:

C - Contract	PR - Project
G - Grant	TA - Task
PE - Program Element	WU - Work Unit Accession No

Block 6. Author(s) Name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. If editor or compiler, this should follow the name(s).

Block 7. Performing Organization Name(s) and Address(es) Self-explanatory.

Block 8. Performing Organization Report Number. Enter the unique alphanumeric report number(s) assigned by the organization performing the report.

Block 9. Sponsoring/Monitoring Agency Name(s) and Address(es) Self-explanatory.

Block 10. Sponsoring/Monitoring Agency Report Number (If known)

Block 11. Supplementary Notes Enter information not included elsewhere such as: Prepared in cooperation with...; Trans. of...; To be published in... When a report is revised, include a statement whether the new report supersedes or supplements the older report.

Block 12a. Distribution/Availability Statement. Denotes public availability or limitations. Cite any availability to the public. Enter additional limitations or special markings in all capitals (e.g. NOFORN, REL, ITAR).

DOD - See DoDD 5230.24, "Distribution Statements on Technical Documents."

DOE - See authorities.

NASA - See Handbook NHB 2200.2.

NTIS - Leave blank.

Block 12b. Distribution Code.

DOD - Leave blank.

DOE - Enter DOE distribution categories from the Standard Distribution for Unclassified Scientific and Technical Reports.

NASA - Leave blank.

NTIS - Leave blank.

Block 13. Abstract. Include a brief (*Maximum 200 words*) factual summary of the most significant information contained in the report.

Block 14. Subject Terms. Keywords or phrases identifying major subjects in the report.

Block 15. Number of Pages. Enter the total number of pages.

Block 16. Price Code. Enter appropriate price code (*NTIS only*).

Blocks 17. - 19. Security Classifications. Self-explanatory. Enter U.S. Security Classification in accordance with U.S. Security Regulations (i.e., UNCLASSIFIED). If form contains classified information, stamp classification on the top and bottom of the page.

Block 20. Limitation of Abstract. This block must be completed to assign a limitation to the abstract. Enter either UL (unlimited) or SAR (same as report). An entry in this block is necessary if the abstract is to be limited. If blank, the abstract is assumed to be unlimited.

ACKNOWLEDGMENTS

Completion of this research would not have been possible without the help of many individuals whose contributions we wish to acknowledge.

First, we acknowledge James H. Banks of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), Presidio of Monterey field unit. Mr. Banks served as COR for this contract. His many insightful ideas and comments, and his effective and timely critiques of concepts, plans, and intermediate products gave focus and structure to this endeavor.

Next, the contributions of James A. Thomas were essential to completing this work. Mr. Thomas was the contract team's on-site representative at ARI, Presidio of Monterey. In this role, he facilitated communications between project team members, who were widely dispersed, and ARI representatives. He also conducted numerous analyses and syntheses in the course of developing concepts and data reported here and was always an effective sounding board for the project team on the realities of unit training. His contributions are much appreciated.

The utmost appreciation must also be expressed to the subject matter experts (SMEs) who contributed to the development of the data presented in this report. James E. Adams, James M. Gill, Donald Smart, Steven Williams, and Niles LaVine spent many hours developing performance estimate data and characterizing collective tasks. Mr. Adams' other roles must also be acknowledged. He developed and verified the databases for the performance estimate data and application of the unit-type and collective-task categorization schemes. Mr. Adams was a continuing source of insight into the thinking of unit training planners and the constraints that exist when planning training. Finally, Mr. Adams conducted the analyses to identify the supporting relationships between collective tasks at different echelons for Infantry unit types. Appreciation also goes to Major Gerald Weiss, United States Army, for his assistance in characterizing collective tasks for Light Infantry unit types.

Thanks also to Ward Keesling and his project team from Planning Research Corporation and the Human Resources Research Organization, particularly Patrick Ford. Mr. Keesling arranged for the project team to acquire data that contributed to our overall understanding and comprehension of the characteristics of the unit training environment. He also provided access to personnel on-site with U.S. Army units to critique data collection plans proposed during the project. Mr. Ford provided insights into the intricacies of the data in intermediate analyses.

We also acknowledge the contributions of K. Ronald Laughery of Micro Analysis and Design, Inc. Mr. Laughery assisted in the conceptual developments for the project. He also participated in development of the unit-type and collective-task categorization schemes and assisted in their application. Finally, Mr. Laughery was a continuing source of support and encouragement to the principal investigator during this effort.

Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	



DEVELOPMENT OF A METHODOLOGY FOR COLLECTIVE TRAINING DECISION MAKING IN ARMY UNITS

EXECUTIVE SUMMARY

Requirement:

The requirement for this research was to develop a method for predicting how collective-task performance will be affected by time without training and changes in unit membership or turnover. This method provides a foundation for tools that assist unit training planners in identifying when collective-task training is needed.

Procedure:

The research had four elements. The first element produced a categorization scheme for unit types, collective tasks, and specific units of a given type. The unit-type categorization scheme was applied to eight unit types, and the collective-task categorization scheme was applied to the collective tasks performed by five unit types. The second element developed regression equations to predict the likelihood of proficient collective-task performance. Subject matter expert (SME) estimates of performance under various conditions of time without training and turnover for 235 collective tasks performed by five unit types were used to develop the regression equations. The predictions from using the unit-type and collective-task categorization schemes were validated against the regression equations. Some of the predictions were also validated against unit performance data acquired during Light Infantry unit rotations to the Joint Readiness Training Center. The third element of the research was to develop a conceptual model of the decision processes used by unit training planners to develop unit training. This model was used as the foundation for developing guidance to assist unit training planners in the fourth research element.

Findings:

The categorization schemes for unit types and collective tasks provide reasonably valid predictions about the relative amount of collective-task performance decrement arising from the combined effects of time since training and turnover. The predictions are not precise enough to enable the use of the same regression equation for more than one task, however. Different regression equations are used for each of the 235

collective tasks. Across the regression equations, the effects on collective-task performance from a 10% turnover in unit membership were found to be about the same as the effect of an additional month of time without training. Also, increased levels of turnover tend to increase the amount of decrement in task performance arising from time without training. The guidance developed for unit training planners supports three phases of training planning: deciding which organizational elements need to train on which collective tasks; developing a training strategy to carry out the needed training; and selecting appropriate training modes to implement training. Tables based on the regression equations support the first phase. Guidance on sequencing training for individual and collective tasks supports the second phase. Recommendations about appropriate training modes given the emphasis in the training strategy support the third phase.

Utilization of Findings:

The results of this research are a first step toward providing more comprehensive guidance for the small-unit training planner. Some of the results have implications for U.S. Army personnel management practices. When high levels of task proficiency are required, turnover, particularly among leadership positions in small units, should be minimized, and adequate opportunities to train should be provided. When unit stability cannot be provided, more frequent collective training will be required to maintain collective task proficiency.

DEVELOPMENT OF A METHODOLOGY FOR COLLECTIVE TRAINING DECISION MAKING IN ARMY UNITS

CONTENTS

	Page
INTRODUCTION	1
Factors That Influence Collective Skills and Collective-Task Proficiency	1
Study Requirement	4
Research Objective and Elements of the Problem	6
Report Overview	7
PROCEDURES	8
Developing the Regression Equations	8
Developing the Conceptual Decision Model	20
Developing Unit-Type and Collective-Task Categorization Schemes	22
Validating the Predictions from the Categorization Schemes	34
RESULTS	40
The Regression Equations	40
Validation of Categorization Schemes	52
Attempts to Simplify User Guidance	71
DECISION MODEL AND USER GUIDANCE	75
A Conceptual Model of Collective Training Decisions	75
User Guidance	77
DISCUSSION	81
AMTPs as a Data Source	83
Implications of Findings for Army Training and Personnel Management	83
Recommendations for Further Research	84
REFERENCES	85
ACRONYMS AND ABBREVIATIONS	87

CONTENTS (Continued)

	Page
APPENDIX A. COLLECTIVE TASKS IN AMTPS EXCLUDED IN THIS RESEARCH	A-1
B. CHARACTERISTICS OF PERFORMANCE ESTIMATION SCENARIOS USED BY SMES TO ESTIMATE PERFORMANCE CHANGE	B-1
C. EXAMPLE ESTIMATION INSTRUCTIONS	C-1
D. INTER-RATER AGREEMENT COEFFICIENTS FOR SME PERFORMANCE ESTIMATION	D-1
E. PROCEDURES FOR RATING UNIT TYPES AND COLLECTIVE TASKS ON FACTORS THAT PREDICT PERFORMANCE CHANGE DUE TO ITI AND TURNOVER	E-1
F. RATINGS OF UNIT TYPES AND COLLECTIVE TASKS ON SUSCEPTIBILITY TO PERFORMANCE CHANGE	F-1
G. PERFORMANCE PREDICTIONS EQUATIONS FOR FIVE UNIT TYPES' COLLECTIVE TASKS	G-1
H. PLOTS OF PREDICTED PROFICIENCY OF COLLECTIVE- TASK PERFORMANCE UNDER A COMMON SCENARIO	H-1

LIST OF TABLES

Table 1. Collective-task performance score changes over a one-month interval	2
2. Characteristics of SMEs who performed estimation task	16
3. Descriptive statistics for inter-rater agreement correlations	18
4. Summary of factors in unit-type categorization scheme	28
5. Factors in collective-task categorization scheme	30
6. Cross-reference for collective-task factor evaluation data	33

CONTENTS (Continued)

	Page
Table 7. Summary of analysis to validate unit-type categorization scheme	35
8. Summary of analyses to validate collective-task categorization scheme	36
9. Tasks included in JRTC validation database analyses	37
10. Selected statistics of coefficients of multiple correlation for regression equations	40
11. Collective tasks whose equations do not contain all possible terms	43
12. Statistical comparison of regression equation terms--"missing" terms equations	44
13. Tests of the proportion of "leader" subtasks for equations with and without turnover terms	45
14. Descriptive statistics of regression equation terms for five unit types	46
15. Raw performance effects of turnover in three personnel categories	47
16. Relative effects on performance of turnover in three personnel categories	48
17. Effects due to ITI and turnover under a common scenario	51
18. Statistically significant correlations between regression equation terms for ITI and turnover	52
19. Significant correlations between unit-type categorization variables and average B weights in regression equations for unit types	53
20. Significant correlations between isolated collective-task factors and regression-equation components	55
21. Significant correlations between CTEP and regression equation terms	56

CONTENTS (Continued)

	Page
Table 22. Results of median tests for isolated collective-task factors	65
23. Median test results for the CTEP	68
24. Results of discriminant analyses--classification success and variables in discriminant function equations	72
25. Example of collective training need look-up table included in user guidance	78
26. Guidance for selecting training modes	80

LIST OF FIGURES

Figure 1. Light Infantry Squad organization	9
2. Mechanized Infantry Squad organization	10
3. Light Infantry Platoon organization	11
4. Mechanized Infantry Platoon organization	12
5. Armor Platoon organization	13
6. Sample plot of performance estimates for two SMEs for one turnover scenario	17
7. A conceptual model of factors that influence collective task performance	24
8. Example plot of predictions from regression equations	42
9. Mean percentage of points assigned to "T" performance category by CTEP numeric score-- Armor Platoon tasks	58
10. Mean number of points assigned to "T" perfor- mance category by CTEP numeric category-- Mechanized Infantry Platoon tasks	59

CONTENTS (Continued)

	Page
Figure 11. Mean number of points assigned to "T" performance category by CTEP numeric score--Infantry Platoon tasks	60
12. Mean percentage of points assigned to "T" performance category by CTEP numeric category--Light Infantry Squad tasks	61
13. Mean number of points assigned to "T" performance category by CTEP numeric score--Mechanized Infantry Squad tasks	62
14. Proportion of cases above the median by CTEP numeric score category--unweighted performance variable	69
15. Proportion of cases above the median by CTEP numeric score category--weighted performance variable	70
16. Plot of average performance for tasks in UTEP+CTEP numeric score categories	71

DEVELOPMENT OF A METHODOLOGY FOR COLLECTIVE TRAINING DECISION MAKING IN ARMY UNITS

INTRODUCTION

Army units at all echelons perform collective tasks in order to accomplish their missions. Proficient collective task performance requires that soldiers and leaders possess two classes of skills: (1) skills that enable them to perform individual tasks proficiently; and (2) skills that enable them to perform as unit members, in performing collective tasks. The latter are referred to as *collective skills* in this report.

Developing and sustaining collective skills is a primary objective of Army unit training. Unit training, however, is often costly in terms of resources and time. This means that unit training should concentrate on the subset of the unit's collective tasks where the training need is greatest. Ideally, this is the subset of tasks on which collective task proficiency is the lowest at a given time.

Identifying when collective task proficiency is inadequate is part of the unit Commander's assessment when planning training—a process that takes place frequently. Unit Commanders rely on several sources of information to assess collective task proficiency. These include unit training records, personal observation of performance, and input from other unit leaders. Information is also available from internal or external evaluations of units performed in accordance with the Army Training and Evaluation Program (ARTEP). Detailed conditions and standards for training and evaluation of collective tasks are contained in ARTEP Mission Training Plans (AMTPs) for many unit types. An AMTP contains Training and Evaluation Outlines (T&EOs) for each collective task performed by a unit type.

Information from these sources enables Commanders to diagnose many cases where performance is inadequate and training is needed. However, the information available to identify training needs may not be always comprehensive. Additional information, in the form of guidance about how often collective tasks should be trained in order to maintain proficiency, would be useful. Empirically based information of this kind has not previously been available. The goal of this research was to develop a systematic means for providing such information.

Factors That Influence Collective Skills and Collective Task Proficiency

Two major factors are involved in the loss of collective skills once the skills are initially developed. These are (1) skill decay associated with intervals without training and (2) changes in unit membership, or turnover.

Inter-Training Interval

Intervals between training on collective tasks are accompanied by collective skills loss, and thus, lower task proficiency, through simple skill decay. Such decay takes place to some extent for all members of a unit. The effects of inter-training intervals on *individual* task performance have been extensively investigated with Army tasks (Rose, *et. al.*, 1984; Rose, Radtke, Shettel, and Hagman, 1985). Essentially no previous work on skill decay in *collective* tasks has been done for real-world tasks, however.

Table 1
Collective Task Performance Score Changes Over a One-Month Interval

Task Title	Number of Platoons Scored on Task	External Evaluation Performance Score	JRTC Performance Score	Performance Change in One Month
Occupy OP/Perform Surveillance	2	.88	.60	-.28
Perform Helicopter Movement	1	.86	.63	-.23
Employ Fire Support	4	.90	.68	-.21
Infiltrate/Exfiltrate	5	.53	.93	+.40
Perform Link-up	3	.83	.58	-.25
Perform Aerial Resupply	2	.57	.59	+.02
Sustain	4	.75	.81	+.06
Perform Tactical Road March	1	.92	.57	-.34
Perform a Passage of Lines	1	1.00	1.00	—
Assault	1	.75	.50	-.25
Occupy a Patrol Base	1	.88	.75	-.06
Consolidate and Reorganize	6	.67	.50	-.17
Move Tactically	9	.67	.63	-.04
Occupy an Assembly Area	7	.84	.67	-.17
Averages	—	.78	.67	-.11

Skill decay influences collective task proficiency over inter-training intervals (ITIs) as short as one month. This is illustrated by the data shown in Table 1. These data are performance scores computed for Light Infantry Platoon collective tasks performed by the same units on two different occasions, approximately one month apart. The figures in Table 1 reflect the proportion of subtasks scored "GO" of the number of subtasks evaluated, according to T&EO criteria. The earlier performance measurements for these tasks were part of an external evaluation program conducted by the Platoons' parent Division. The later measurements were made during training at the Joint

Readiness Training Center (JRTC). A total of 47 measurements of Platoon collective task performance were available for both occasions of measurement.

As Table 1 illustrates, most tasks showed decrements in performance over one month, with an average decrement over all task performances of 11 percent. While other factors that were not measured, such as turnover, could have contributed to these performance decrements, there is a clear tendency for collective task performance to deteriorate over even a brief period without training. The average amount of performance change for these measurements is similar to that which occurs for *individual* tasks that are not very sensitive to skill decay (Rose, Radtke, Shettel, and Hagman, 1985).

Available data indicate that the intervals between training for any particular collective task can be much longer than one month. Examining Weekly Training Schedules (WTSs) covering a six-month period, for a Company in a Cavalry Battalion Task Force, we found only five instances where any Platoon collective task was scheduled more than once. Twenty-seven different Platoon collective tasks were represented on these schedules. For each of the two other Companies in the same Battalion, only one Platoon collective task appeared more than once on the WTSs during the six-month period.

Roth (1990) reviewed WTSs and training calendars for Multiple Launch Rocket System (MLRS) units and gathered anecdotal data, in an attempt to determine task training frequency. While specific ITIs were not available, the information indicated that intervals between training in the field for the units contacted ranged from a few weeks to over a year (in one case). Many of the tasks performed by MLRS units can only be trained meaningfully in the field environment.

While these data are not comprehensive, they provide some evidence that collective task training in units can be infrequent, and ITIs can be long. Thus, there are frequent opportunities for collective task performance to suffer as a result of skill decay.

Unit Membership Change

Unit membership change, or turnover, also results in the loss of collective skills. When an individual leaves a particular unit, the skills he or she has learned for performing as a member of that unit are lost. This can result in a decrement in collective task performance until new unit members acquire appropriate collective skills. The greater the amount of turnover in a unit, the larger the proportion of collective skills that must be re-developed through collective training.

A similar effect can occur when unit members change the positions they occupy in a unit (turbulence), which often accompanies turnover. Somewhat different collective skills may be required to perform effectively in a new position. This may result in a collective task performance decrement for the unit at large, until the needed skills are acquired by individuals in new positions.

Data from two studies illustrate the amount of turnover experienced by Army units. From a study of factors that influence unit performance at the National Training Center (NTC; PRC, 1989), turnover rates reported for an Armor Battalion were 14, 18, 12, 15, and 9 percent per month for five successive months. The average of these figures is 13.6 percent per month, or an annual turnover rate of 177 percent.

Other data from the same study give a different perspective on unit personnel change. For three Battalions, the percent of personnel who remained in the same Battalion over a three-month period just prior to an NTC rotation was 89.6, 77.5, and 87.5 percent. These figures suggest that the average level of turnover in units of this size is roughly five percent per month, or 60 percent per year.

Levels of turnover reported by members of two MLRS Battalions and three MLRS Separate Batteries (Roth, 1990) ranged from 4.3 to 14 percent per month, averaging 10.5 percent per month. This is the equivalent of about 125 percent per year turnover.

Study Requirement

The requirement for this research was to develop a method for predicting how collective task performance will be affected by time without training (ITI) and changes in unit membership, or turnover. This method is a foundation for providing tools that assist unit training planners to identify when collective task training is needed.

Two other classes of users may also benefit from the results of the research. These are: (1) Combat and Training Developers in the U.S. Army Training and Doctrine Command (TRADOC) schools; and (2) Department of the Army (DA) mobilization planners. TRADOC school personnel may use these methods, and the resulting predictions about the effects of ITI and turnover on task performance, to develop or improve guidance (such as AMTPs) for unit training planners. Mobilization planners may use one of the intermediate products of this research—a classification scheme for unit types and collective tasks—to develop plans that enable mobilizing units to rapidly gain collective task proficiency.

The majority of this report is oriented toward the primary users of the research results—unit training planners. At appropriate points, the use of the research products by other users is discussed.

Existing Support and Information Related to the Requirement

What is presently available to assist unit training planners to identify collective training needs? In addition to the usual sources of information used by Commanders in their training assessments, the available resources include a recently-fielded training management software system and the general literature on team performance. These are briefly discussed in the following paragraphs.

The Standard Army Training System (SATS). Many unit training planners have access to the Standard Army Training System (SATS), a software tool that operates on personal computers, to support training planning. SATS provides information, records management, and functional support to unit training planners in accomplishing four broad training management functions:

1. Developing the Mission Essential Task List (METL) for a unit, and approving the METLs of subordinate units;

2. Developing training strategies and plans based on prior assessments of proficiency;
3. Managing training resources and identifying resource constraints; and
4. Maintaining records of evaluations of task and Battlefield Operating System (BOS) performance proficiency.

SATS is primarily a record-structuring and -keeping aid, with computational capabilities to assist in training resource forecasting and management.

SATS provides information that assists in the identification of performance shortfalls, and therefore likely training needs, in the form of records of prior training assessments. These records, however, do not extend (in SATS) below the Company level. Assessment-based assistance is not available in SATS for making training decisions for lower echelons (platoons, and Squads or Crews). However, units at these lower echelons perform collective tasks that support higher-echelon collective tasks. One possible application of the results of the present research is to provide additional capabilities within SATS to enable identifying training needs for lower-echelon collective tasks.

SATS also supports the development of training strategies and training plans, through the capability for the user to define training events and associate training for specific METL tasks with each event. Again, collective tasks performed by lower echelons are not directly addressed in this capability. The decisions involved in developing the training strategy are not supported by SATS; the results, in terms of detailed training schedules and plans, are supported.

In summary, SATS provides support for training planning, record-keeping, and resource management, and information that supports training decisions for higher echelon tasks. Not present in SATS are capabilities to track lower-echelon task training and performance, or to support training decisions for lower-echelon collective tasks.

The General Literature on Team Performance. The general literature dealing with team performance provides a rich resource of hypotheses, speculations, and limited conclusions about the influences of many factors on team performance (in which collective task performance by Army units is included). However, the literature does not include systematic studies of the effects of ITI and turnover on the performance of real-world tasks. Most research has not dealt with real-world tasks and teams, and is limited in generalization and applicability of results to real-world issues. Several authors, among them Bass (1982) and Dyer (1984), have called for more focus on real-world tasks and teams than has been the norm in previous research. A consensus can be drawn from the literature, however, that there are three broad classes of factors that influence team or unit performance (Goldin and Thorndyke, 1980; Denson, 1981; Freeberg and Rock, 1987; Salas, Dickinson, Converse, and Tanenbaum, in press). These are:

1. Factors associated with the organization, structure, and tasks performed by *types* of teams or units (*e.g.*, number of members, formal organizational structure, etc.). This class of factors is useful for identifying possible differences among the effects of ITI and turnover on performance across the many different types of units within the Army organization.
2. Factors associated with the *tasks* performed by a specific type of team or unit (*e.g.*, number of steps, the ability of members to compensate for other members'

inadequate performance, etc.). Since Army units perform many different collective tasks, this class of factors is useful for identifying possible task-related differences in the effects of ITI and turnover on collective task performance.

3. Factors associated with characteristics of the *members* of a specific team or unit of a particular type (*e.g.*, aptitude, job experience, experience in performing as a team member). Factors in this class may help to account for differences in collective performance by otherwise similar units of the same type (*e.g.*, Light Infantry Squads).

Numerous factors in each of these classes have been identified as having influences on the performance of teams and team tasks in the general literature. Later in this report, a classification scheme for unit types and collective tasks is presented. This classification scheme was developed from a review of the general literature on team performance.

Current work in the area of team performance (*e.g.*, Cannon-Bowers, Salas, and Converse, 1990; McIntyre, Morgan, Salas, and Glickman, 1988; Stout, Cannon-Bowers, Morgan, and Salas, 1989; Covert, Cannon-Bowers, and Salas, 1990; Salas, Dickinson, Converse, and Tanenbaum, in press) is concentrating on studying the initial development of teamwork skills and evolving practical interventions to assure effective team training. While this research has produced significant advances in understanding the phenomena of teamwork development, it is not directly relevant to the goals of the present work. The major concern in this research is with the retention of skills that have already been acquired, rather than methods for initially developing those skills.

Research Objective and Elements of the Problem

The overall objective of this research was to develop methods for obtaining and using information about the effects of ITI and turnover on collective skill loss, to predict the need for training on collective tasks performed by Army units. To achieve this objective, the research was divided into four elements. These are:

1. Develop a classification scheme to predict the relative amount of influence of ITI and turnover on collective skills loss, for both unit types and collective tasks. As mentioned, this classification scheme was based on findings in the general literature on team performance.

This element was needed for two reasons. First, only a sample of Army unit types was addressed in this research. A means is needed to generalize from this limited sample to other types of units and the collective tasks they perform. The classification scheme enables this. Second, a classification scheme that successfully predicts the relative influence of ITI and turnover on collective skill loss can simplify the guidance provided to unit training planners. This can be done by identifying groups of collective tasks for which the effects of ITI and turnover are similar, and using the same predictions for all the tasks in each group. For example, some of the guidance for unit training planners consists of tables giving the predicted level of training need for tasks for different levels of ITI and

turnover. If tasks are grouped according to a successful classification scheme (*i.e.*, one table per group of tasks), fewer tables are needed to cover all the collective tasks for a unit type.

2. Develop regression equations that predict the amount of collective skill loss given the length of the ITI and level of turnover in a unit. The regression equations are used to make training need predictions for collective tasks. This required developing a method for estimating the amount of collective skill loss for different amounts of ITI and turnover, so that the regression equations could be developed.
3. Develop a conceptual model of the major decisions involved in unit training planning, and the factors that must be taken into account in making those decisions. This provides a structure for applying the training need predictions and providing guidance for developing training plans.
4. Develop guidance for using the training need predictions and developing unit training plans. This user guidance provides support for all of the major decisions involved in planning unit training. These include deciding what training is needed, developing a strategy to accomplish the training, and selecting cost-effective training modes to implement the training strategy.

Report Overview

The remainder of this report describes the accomplishment of the research elements above, to achieve the overall objective of the research. The second section of the report describes the procedures used to accomplish three of the research elements: (1) developing the regression equations; (2) developing the conceptual model of training decisions; and (3) developing the classification scheme. The third section presents the results of developing the regression equations and the classification scheme. The fourth section sets forth the training decision model and describes the user guidance developed to support the decisions. The final section presents conclusions from the research and recommendations for future work.

PROCEDURES

This section of the report describes the procedures used to perform three of the four elements of the research problem, in four subsections. First, development of the regression equations for predicting collective skill loss is discussed. Next, we discuss the development of the conceptual model of decisions and factors involved in the process of planning unit training. Third, the procedures used to develop and apply the classification schemes for unit types and collective tasks are set forth. Finally, we discuss the procedures used to validate predictions from the unit type and collective task classification schemes.

Developing the Regression Equations

The objective of this element of the research was to develop regression equations that predict the amount of collective skills loss for collective tasks, given information about the Inter-Training Interval (ITI) for the task and the amount of turnover in a unit. Originally, it was intended that these equations be based on data gathered from Forces Command (FORSCOM) units. For a variety of reasons, an alternate approach to obtaining collective skills loss data was adopted.

The approach chosen was to have Subject Matter Experts (SMEs) estimate the performance of hypothetical units on different collective tasks under different conditions, or scenarios, of ITI and turnover. This estimation task was done for collective tasks performed by five different unit types:

1. Armor Platoon (estimates made for 64 collective tasks)
2. Mechanized Infantry Platoon (58 tasks)
3. Light Infantry Platoon (45 tasks)
4. Light Infantry Squad (38 tasks)
5. Mechanized Infantry Squad (30 tasks).

Since there will be discussion of these unit types throughout the report, Figures 1 through 5 are provided to describe the organizational structure of each unit type. In these Figures, personnel classified as senior leaders and junior leaders in each unit type are indicated by the letters "SL" and "JL," respectively.

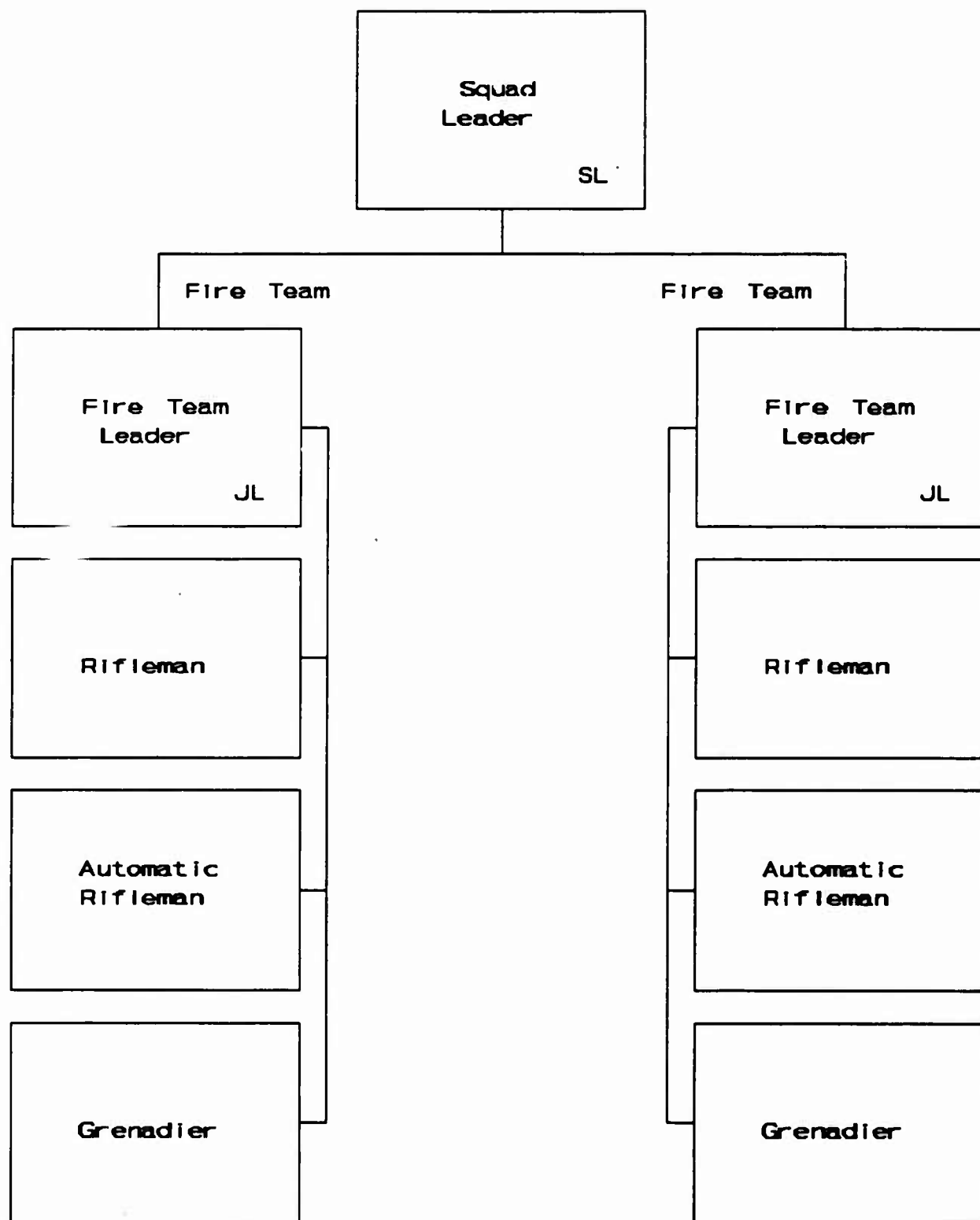


Figure 1. Light Infantry Squad Organization.

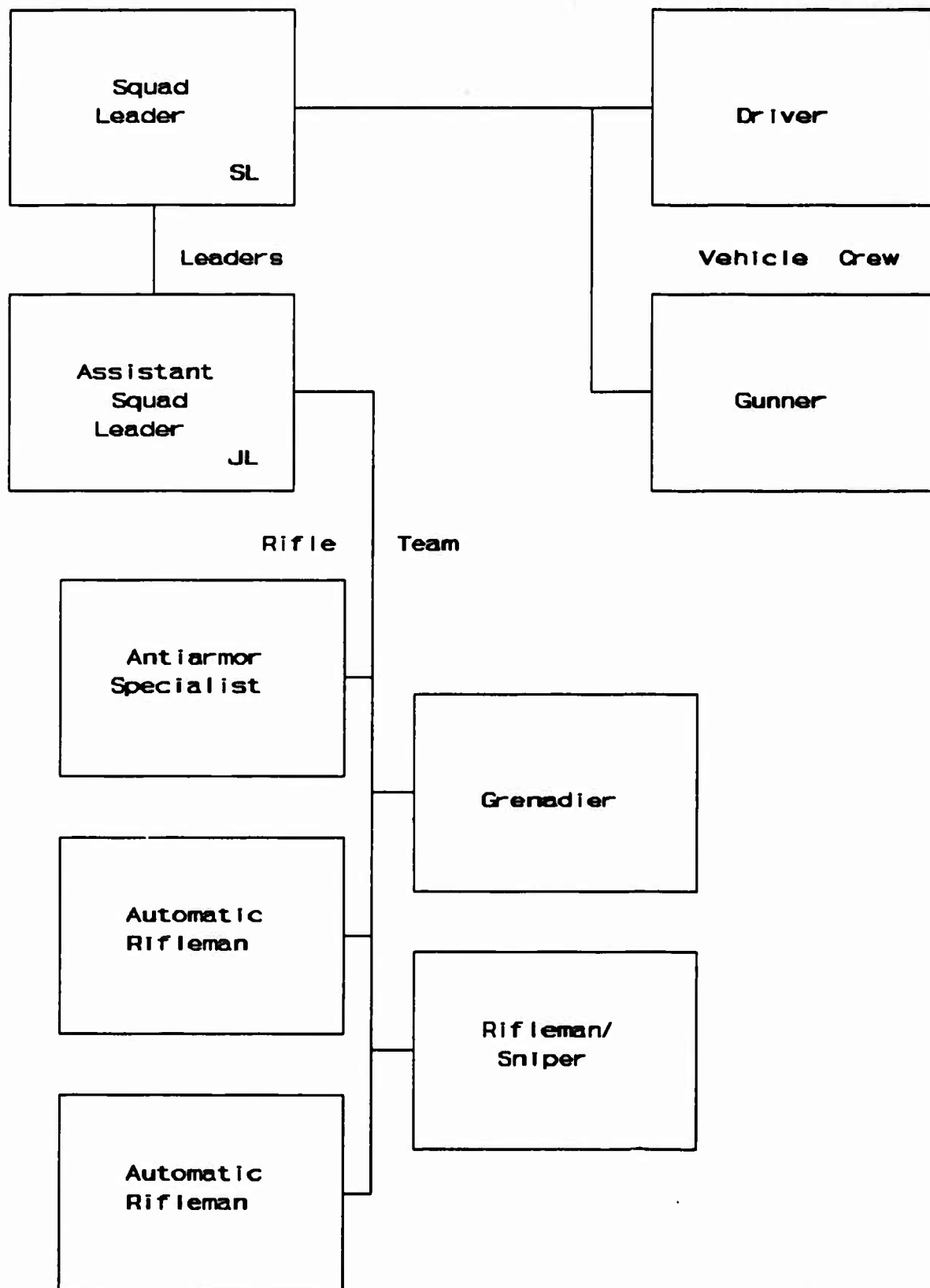


Figure 2. Mechanized Infantry Squad Organization.

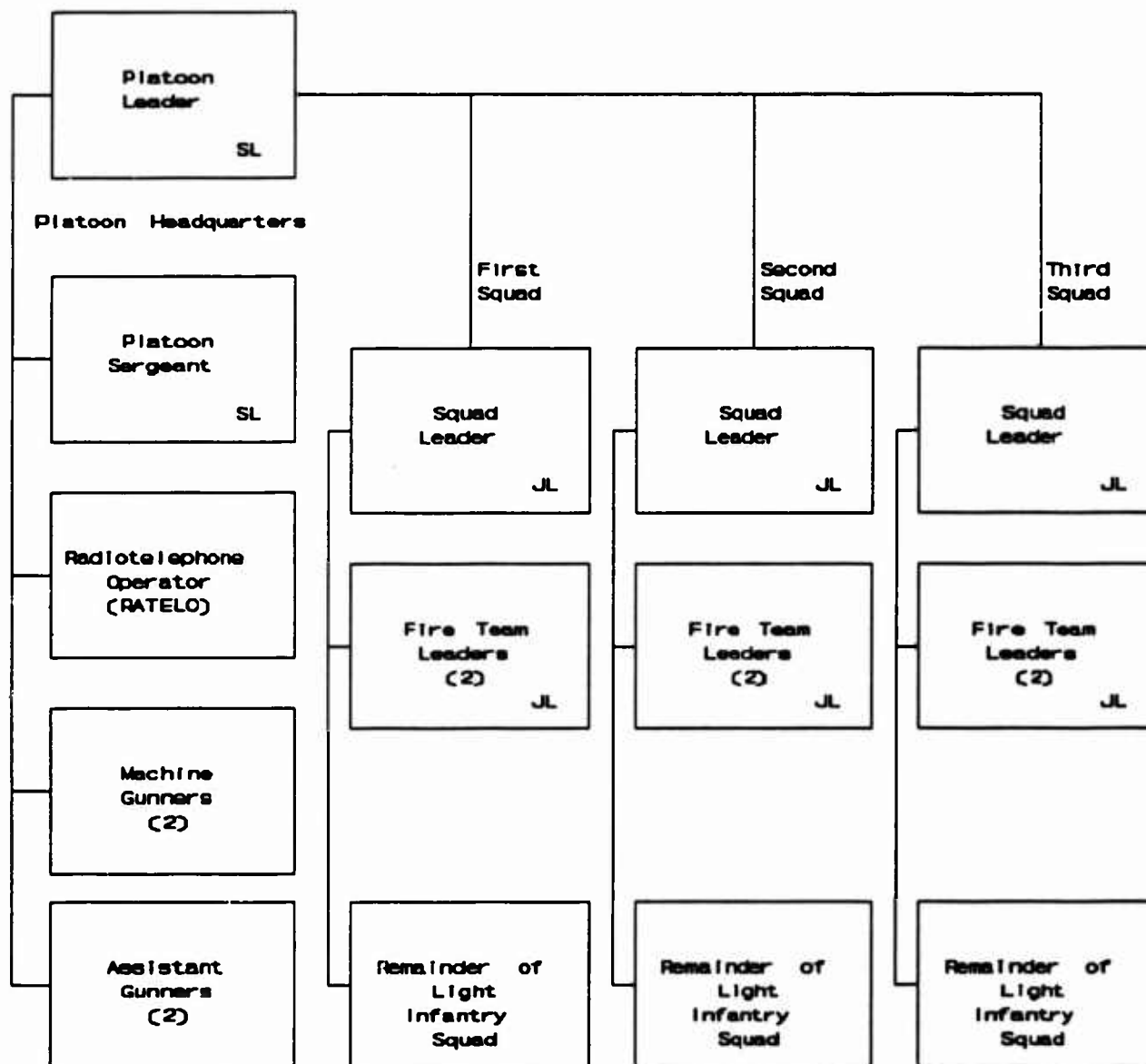


Figure 3. Light Infantry Platoon Organization.

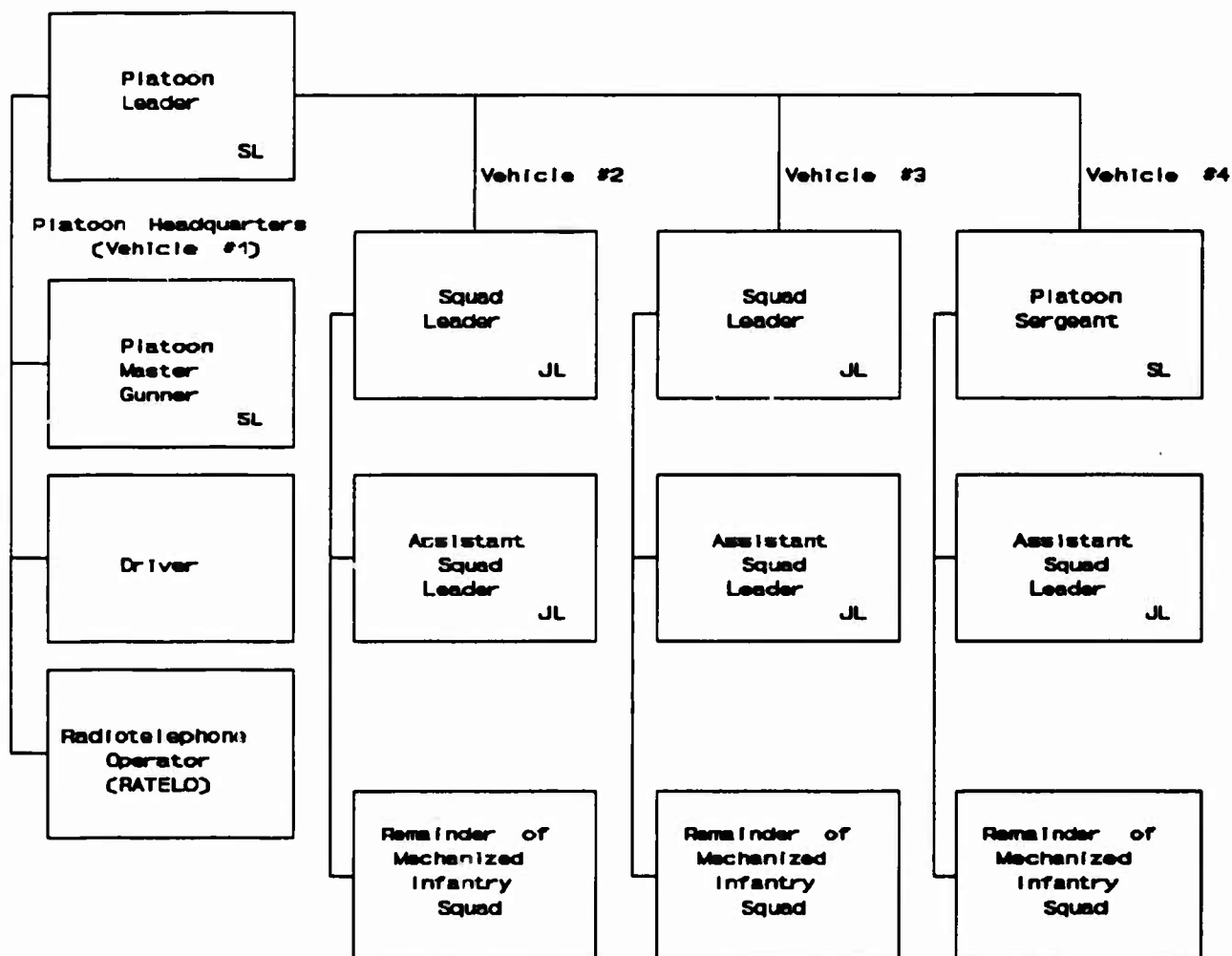


Figure 4. Mechanized Infantry Platoon Organization.

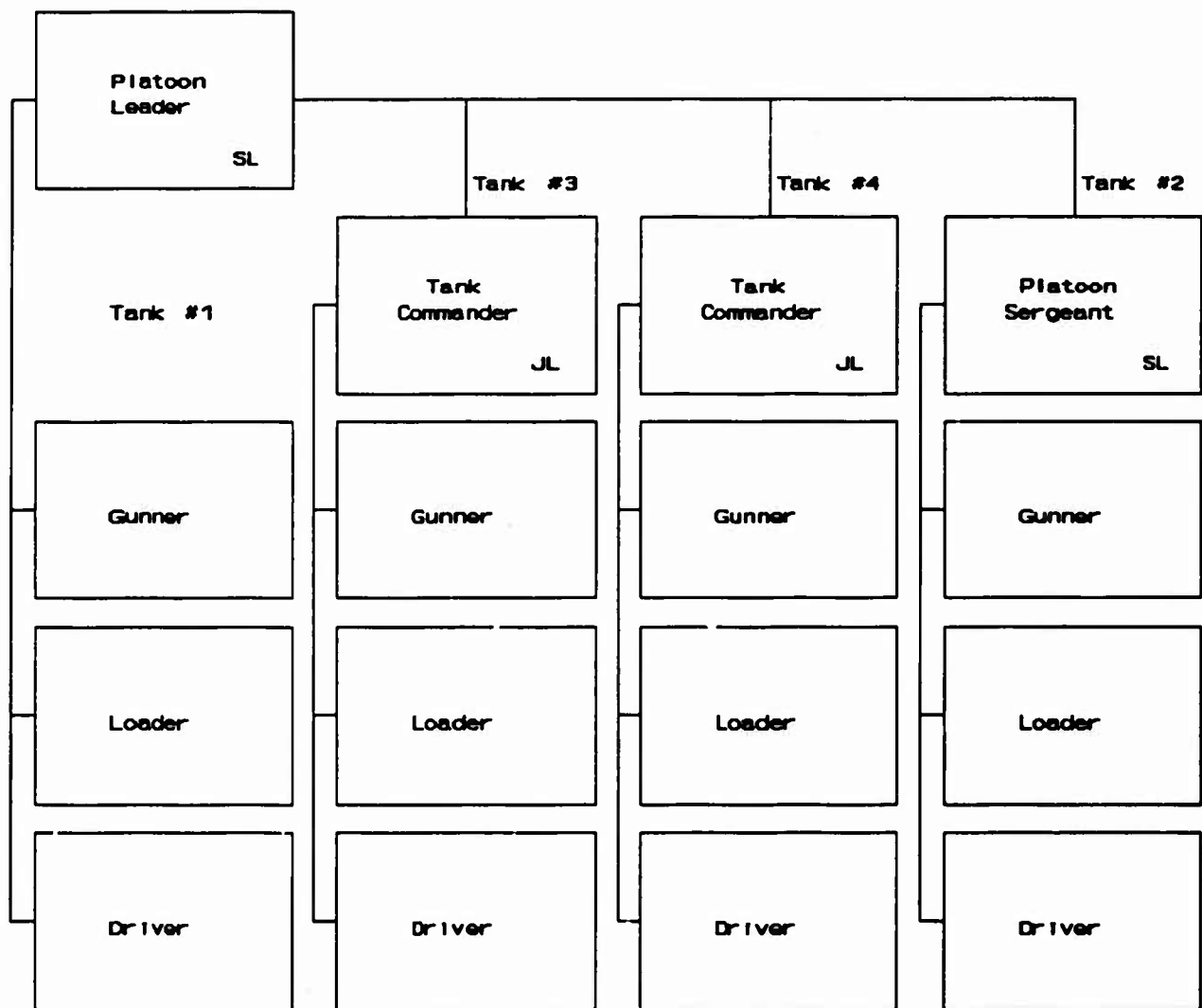


Figure 5. Armor Platoon Organization.

Collective Tasks

The tasks for which estimates were made are a subset of the collective tasks performed by the unit types. Tasks for some unit types were excluded because the available task descriptions (T&EOs in the AMTPs) do not provide enough detail about how the task is performed. The tasks *excluded* are listed for each unit type in Appendix A. These tasks were actually eliminated from consideration during application of the classification scheme for collective tasks, discussed later in this section of the report.

The Scenarios

Either 28 or 52 scenarios that represent unique combinations of ITI and turnover were prepared for each unit type. Unit types with larger numbers of members (Mechanized Infantry and Light Infantry Platoons) each had 52 scenarios developed. Unit types with fewer members each had 28 scenarios developed. The ITI's used in the scenarios were 1, 2, 4, and 6 months since training. Each ITI value was used with either 6 or 12 descriptions of turnover, plus a no-turnover condition, to make up a set of scenarios for a unit type.

Turnover was described in the scenarios by listing the titles of positions where turnover had taken place during the interval without training. For example, turnover in some scenarios for Mechanized Infantry Platoons was described as "Platoon Leader, two Noncommissioned Officers (NCOs), and twelve soldiers." Leader titles were listed by position (*e.g.*, Platoon Leader, Assistant Squad Leader). Turnover in non-leader positions was described by a count of the number of soldier positions where turnover took place (*e.g.*, twelve soldiers).

Turnover descriptions for the scenarios were prepared by an SME who was given descriptions of the different turnover conditions to be included. These descriptions were slightly different for each unit type, because of the differences in organizational structures between unit types. The SME was also given criteria for overall levels of turnover to be described. A low level of overall turnover in a unit was 20 to 30 percent. A high level of turnover was 50 percent or more. These levels of turnover were chosen to span the range of turnover rates estimated to take place in real-world units (presented in the previous section of the report).

The scenarios for four of the five unit types included variations in the level turnover of senior leaders, junior leaders, and soldiers. Scenarios for the Armor Platoon included variations in the level of only senior leaders and soldiers.

The descriptions of time since training and turnover used in the scenarios for all five unit types are presented in Appendix B.

The Estimation Task

The estimation task required SMEs to estimate how a hypothetical unit would perform if it were given an external evaluation on a specific collective task, given the ITI and turnover conditions described in each scenario. SMEs estimated unit performance by assigning 100 points across the

categories "T" (Trained), "P" (Needs Practice), and "U" (Untrained), for each scenario. These are the performance rating categories used to describe overall unit performance, as prescribed in AMTPs. For example, an SME could indicate that unit performance on a task, for one scenario, was relatively high by assigning points to the categories in this fashion:

Points Assigned to "T" category	Points Assigned to "P" category	Points Assigned to "U" category
95	5	0.

A lower level of performance on a task for a scenario might receive point assignments like these:

Points Assigned to "T" category	Points Assigned to "P" category	Points Assigned to "U" category
60	30	10.

All 100 points were required to be assigned to some category, for each estimate. An SME made one performance estimate for each scenario, for each collective task performed by a unit type.

The SMEs were instructed to keep in mind three assumptions about the hypothetical units for which they made estimates of performance. These were:

1. The hypothetical unit began the ITI at full strength: every position was filled with personnel of the authorized grade.
2. Each member of the hypothetical unit was capable of performing all individual tasks specific to his Military Occupational Specialty (MOS) and skill level, at the beginning of the ITI.
3. The collective task was performed well by the hypothetical unit when it was last performed: it received a "T" rating before the ITI.

These assumptions were given to limit the variables that SMEs considered when making performance estimates. Variations in unit strength, individual qualifications, and previous levels of performance can each influence a unit's performance on a collective task. Our goal was to encourage SMEs to concentrate on estimating the influences of ITI and turnover on performance, without considering other variables. A sample of the instructions given to the SMEs for the estimation task is shown in Appendix C.

To perform the estimation task, SMEs were given the scenarios, forms for recording their performance estimates, and copies of the collective task descriptions contained in T&EOs. Most SMEs used other documents that describe how the collective tasks are performed to supplement the task descriptions from the T&EOs.

Performance estimates were made for each collective task for a unit type by two different SMEs, working independently. Altogether, five SMEs participated in the estimation task. Each SME made performance estimates for the collective tasks performed by two different unit types. SMEs

Table 2**Characteristics of SMEs Who Performed Estimation Task**

SME	Background and Experience	Unit Types Estimated
1	Retired Army Colonel; Armor; 24 years' experience; former Battalion Task Force Commander; combat experience	Armor Platoon, Mechanized Infantry Platoon
2	Retired Army Lieutenant Colonel; Armor; 20 years' experience; former Battalion Executive Officer; combat experience	Armor Platoon, Mechanized Infantry Squad
3	Separated Army Captain; Armor; 6 years' experience; recent experience as Company Commander	Mechanized Infantry Platoon, Mechanized Infantry Squad
4	Army Reserve Captain; Infantry; 6 years' active duty experience, 10 years' reserve experience; former Infantry Company Commander, currently commands Combat Engineer Company; combat experience	Light Infantry Platoon, Light Infantry Squad
5	Army Reserve Sergeant First Class; Infantry; 8 years' Marine Corps active duty experience, 8 years' Marine Corps Reserve and 3 years' Army Reserve experience; currently S-3 Training NCO in Infantry Battalion; combat experience	Light Infantry Platoon, Light Infantry Squad

made estimates for the unit types with which each SME had the most experience. Table 2 describes the background of each SME and indicates the unit types for which each SME made performance estimates.

After the performance estimation task was complete for each SME and unit type, data recording errors were identified and corrected. SME estimate data were then entered into a database for preliminary examination and analysis.

Examination of SMEs' Estimate Data

Data from the SME performance estimation task were examined and analyzed, to decide how to combine the data from the estimates made by the two SMEs that gave estimates for each unit type.

First, plots were made of the number of points assigned to the "T" performance category by both SMEs, for each collective task. Data points for all of the scenarios for a task were plotted on the same graph, so that patterns in the SMEs' point assignments could be compared. Then, inter-rater agreement was computed between the two SMEs that made estimates for each collective task.

Data Plots. The data plots for all tasks, across all unit types, showed that both SMEs estimated increasingly lower levels of performance as ITI increased from one to six months. The decrements in estimated performance generally followed the form of the classic retention curve for individual tasks (Farr, 1986). For these tasks, the overall decrement in estimated performance after a six-month ITI was smaller than that for most individual tasks (Rose, Radtke, Shettel, and Hagman, 1985). Figure 6 shows a sample plot for one turnover scenario and the four ITIs that illustrates the general form of the

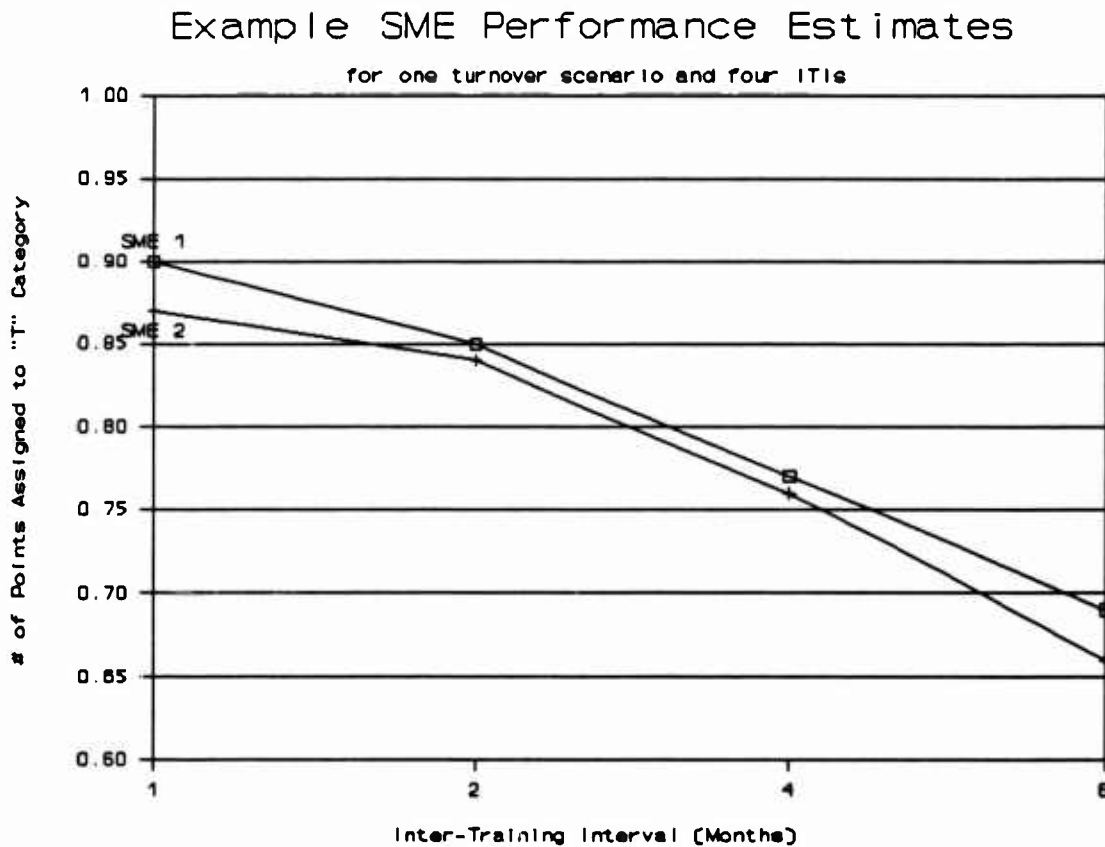


Figure 6. Sample plot of performance estimates for two SMEs for one turnover scenario.

performance decrements. Plots for two SMEs are shown in this example, to illustrate that SMEs' estimates of performance were generally similar, but not identical.

The two SMEs that made estimates for each unit type's collective tasks generally estimated similar effects of turnover on performance. SMEs consistently estimated lower levels of performance for scenarios with larger amounts of turnover. This was true both when comparing estimates for scenarios that differed in overall turnover and those that differed only in turnover in one of three

personnel categories—senior leaders, junior leaders, and non-leaders. This finding was consistent across collective tasks and unit types.

For the scenarios that specified no turnover, the two SMEs' estimates of performance decrement differed slightly. Usually, one SME tended to estimate lower levels of performance than the other, across collective tasks for a unit type. The differences between the SMEs' estimates were generally small (5 to 10 points assigned to the "T" category).

SMEs seldom assigned fewer than 50 points to the "T" category, even for scenarios with large amounts of turnover and long ITIs. The reason why is unknown. This could mean that SMEs do not consider that the differences in collective task performance are significant after performance has deteriorated beyond a certain level.

In summary, the plots of performance estimates made by different SMEs were similar across both scenarios and collective tasks for each unit type.

Inter-rater Agreement. Simple correlations were computed between the number of points assigned to the "T" category by the two SMEs that made performance estimates, for each collective task. Performance estimates for the 28 or 52 scenarios for each task were cases for these computations. The resulting correlation coefficients measure agreement between the performance estimates of the SMEs that made estimates for each task. The task-by-task correlation coefficients are presented in Appendix D. Table 3 shows summary statistics for inter-rater agreement correlations.

Table 3 shows that there was reasonably good agreement between the performance estimates made by the two SMEs for each unit type. The highest inter-rater correlations are for the estimates for Armor Platoon collective tasks. There was somewhat less agreement between SMEs' estimates for collective tasks performed by Light Infantry Platoons and Squads. The lowest levels of agreement

Table 3

Descriptive Statistics for Inter-Rater Agreement Correlations

Unit Type	Mean Inter-Rater Agreement r	Mean Inter-Rater Agreement r^2	Inter-Rater Agreement r Std. Dev.
Armor Platoon	.9262	.8578	.0503
Mechanized Infantry Platoon	.7310	.5344	.1061
Light Infantry Platoon	.7845	.6156	.1179
Light Infantry Squad	.8672	.7520	.0742
Mechanized Infantry Squad	.6580	.4330	.1280

were for SMEs' estimates for collective tasks performed by Mechanized Infantry Platoons and Squads. The lower levels of agreement between SMEs' estimates for Infantry unit types may be

related to the level of detail and comprehensiveness of the collective task descriptions provided by the T&EOs. This is discussed further in the final section of this report.

The Performance Criterion for Analysis

We decided to average the number of points assigned to the "T" category by the two SMEs for each scenario, and use these averages as criterion data for developing regression equations.

We chose to use the number of points assigned to the "T" category, because it represents the best estimate of the likelihood of error-free task performance. This makes the measure easier both to explain and to interpret. We considered using a measure that added one-half the points assigned to the "P" category to the points assigned to the "T" category, giving "half credit" for task performances with minor errors. Using this measure, however, would not reflect all of the performance decrement estimated by the SMEs.

The SMEs' data points for each scenario were averaged because there was no basis on which to select one SME's estimates over the other's as an estimate of actual performance. If other data had been available to guide a decision, we would have selected one SME's estimates for each collective task as the better fit to actual performance, and used those data as the criterion for developing regression equations. Having no criterion to select between the SMEs' estimates, we averaged them.

Regression Equation Development

Regression equations were developed for all 235 tasks for which SME estimates were made. A separate equation was developed for each collective task. Each scenario for a collective task was one case for these analyses. The criterion variable was the one described above. The predictor variables in the regression analyses were:

1. The number of months since training (ITI) described in the scenario;
2. The percent turnover of senior leaders described in the scenario;
3. The percent turnover of junior leaders described in the scenario; and
4. The percent turnover of non-leaders described in the scenario.

Raw data values were used for all variables. No exponential or power terms of predictor variables were included in the regression analyses.

A stepwise multiple regression procedure was used to develop the regression equations. Predictor variables were not forced into the equations. Predictor variables were included in the multiple regression equations on the basis of increasing the coefficient of multiple correlation between the set of predictor variables in the equation, and the criterion variable.

Characteristics of the regression equations are discussed in detail in the next section of the report.

Developing the Conceptual Decision Model

The purpose of this element of the research was to identify the major decisions involved in planning collective training and the factors that should be considered when making those decisions. This provided a framework for developing user guidance to assist unit training planners. Parts of the user guidance were also developed in this element of the work.

The first step in developing the model was a thorough review of documents that outline Army doctrine and guidance for planning and carrying out unit training. These included a sample of AMTPs and 25- series Field Manuals (FMs). This review identified the major decisions, and gave an understanding of the context and constraints in which unit training decisions are made.

The next step was to meet with SMEs with knowledge of the details of unit training planning. This meeting had three goals:

1. Verify that the major decisions have been identified, and identify the factors that should be considered in making the decisions;
2. Identify what information and guidance is presently available to help training planners make trade-offs between factors; and
3. Identify needs for additional information to help training planners make trade-offs and develop effective training plans.

All these goals were accomplished. Requirements for developing additional information and guidance to assist training planners were established, based on findings from the meeting. Additional guidance is needed in three areas (in addition to ways to apply the training need predictions from applying the regression equations):

1. Identifying prerequisite or supporting relationships between collective tasks performed by different echelons. For example, Squad collective tasks support Platoon collective tasks, but information is not available to identify exactly which Squad tasks support which Platoon tasks. Existing guidance outlines the relationships between collective tasks and supporting *individual* tasks. It does not outline relationships between collective tasks performed by different echelons. This information is useful in developing a training strategy, to assure that prerequisite training is accomplished before more advanced or higher-level training that builds on the foundation of the prerequisites.
2. Factors to consider in developing a training strategy. Existing guidance documents (e.g., FM 25-2) include broad, general statements of principles for training strategy development, but lack guidance about details. Having more detailed guidance can improve unit training strategies.
3. Selecting training modes to implement a training strategy. Existing guidance identifies many training modes, but provides essentially no guidelines for choosing among them. Some training modes are more appropriate under one training

strategy emphasis than another. Guidance for making trade-offs between the emphasis in the training strategy and training modes can help training planners achieve cost-effective training.

Developing information and guidance to meet these needs was the emphasis in the rest of this element of the research.

Identifying Supporting Collective Task Relationships

An SME with an Infantry background reviewed the collective tasks performed by Light and Mechanized Infantry Platoons and Squads, and identified which Squad tasks support, or are prerequisites for, which Platoon tasks. The reviews for Light and Mechanized Infantry unit types were made separately. The decision rule used in the review was that if a Platoon collective task cannot be successfully accomplished unless a particular Squad task is accomplished, the Squad task supports the Platoon task. The results of the review were documented as lists of Platoon tasks, with prerequisite Squad tasks listed below each Platoon task. These lists are presented for reference in the user guidance.

Developing Guidance for Training Strategy Development

A training strategy is developed to satisfy the training need that is defined by unit task performance deficiencies. Developing a training strategy requires decisions about which units and sub-units will be trained on which collective tasks, and in what order, or sequence, the training will take place. It also involves finding ways to accomplish the needed training within larger-scale training plans and under the training constraints that exist for all units.

Existing guidance for the second part of developing a training strategy (working within schedules and constraints) is more detailed and comprehensive than for the first. Therefore, we concentrated on developing guidance to help training planners order and sequence tasks for training.

The point of departure for developing training strategy guidance was the list of factors to be considered in developing a training strategy. This list was originally developed during the SME conference discussed above. The initial guidance was developed by further reviews of Army documents that provide guidance for training planning, the general literature on team performance (for hints on team training), and the general literature on training. A second meeting with SMEs was held to review, expand, and simplify the initial guidance. Revisions were made to the initial guidance during the SME meeting. The guidance for developing training strategies is presented as a list of factors for users to consider, along with suggestions for structuring training to gain the most benefit from the training time investment.

Developing Guidance for Training Mode Selection

Some training modes are more appropriate for carrying out certain types of training strategies than other modes. Existing doctrine for training planning gives little, if any, guidance on which training modes are appropriate for implementing which training strategies.

To develop guidance for selecting appropriate training modes, we first identified the training modes that are feasible for smaller units (Company and below) to use in carrying out their training plans. Training modes such as Combined Arms Live-Fire Exercise (CALFEX) and Combat Training Center (CTC) rotations were excluded, because these modes are not oriented toward smaller-unit training.

Next, the types of training for which each training mode is most appropriate were identified. This was done through comparing the types of training objectives that are likely to be established for smaller unit types against the kinds of objectives that can be carried out in each of the training modes. The initial pairings of training modes and objective types were reviewed by SMEs and revised.

Finally, the relative amount of training resources required to train in each mode was specified. This was done by reviewing existing Army documentation for training planning.

The results of these developments were combined into a table that suggests the most appropriate training modes for carrying out particular kinds of training strategies. This table also includes factors that planners should consider when choosing to use each training mode. The table was included in the user guidance.

Developing Unit Type and Collective Task Categorization Schemes

The objective of this element of the research was to develop methods to predict the relative amount of collective skills loss that will take place due to ITI and turnover, for unit types and collective tasks. This was required for two reasons. First, attention was given to only a sample of unit types and collective tasks in this work. To generalize from the findings of the research, a means of identifying how similar other unit types and collective tasks are to those we worked with is needed. Second, we hoped to be able to simplify parts of the user guidance by having a collective task classification scheme. This could allow us to use the same collective skill loss predictions for more than one collective task.

The approach we followed was to examine the general literature on team performance, to identify factors that influence the way in which ITI and turnover are related to collective skills loss. To provide a way to select from the many candidate factors that have been proposed to influence team performance, we first adopted a conceptual model of team or unit performance. This model enabled us to develop a decision rule for choosing factors for the categorization schemes.

Conceptual Model

The unit performance model we used to develop a decision rule is presented in flowchart form in Figure 7. This model is adapted from a team performance model originally presented by Bass (1982). The model was adapted for our purposes because Bass' model dealt with less-structured groups and purely cognitive tasks, in addition to the well-structured teams or units and mixed-type

tasks¹ performed by Army units. Factors in Bass' model that dealt with less well-structured groups were deleted and the pattern of influences were somewhat reorganized to give the conceptual model in Figure 7.

The model identifies the relationships between the various factors that influence collective task performance by units. Factors that influence performance via the design of a unit type are in round-cornered rectangular shapes. Factors that influence performance through the characteristics of collective and individual tasks performed by a unit type are in hexagonal shapes. Factors that influence performance via the capability of unit members to express skills and knowledge are in square-cornered rectangular shapes. Finally, situational factors that influence collective task performance are in oval shapes. Collective task performance—the output of the model—is shown at the lower right of the Figure.

Influences on performance that are driven by unit design and task characteristics factors are depicted in Figure 7 by thin solid lines connecting shapes. These are the least variable influences on collective task performance, since they change only when unit design is altered or different collective tasks are assigned to a unit type. Thick solid lines connecting shapes show influences driven by unit members' capability to express skills and knowledge. These are more highly variable influences on performance, because unit membership and the available pool of collective skills change frequently.² Open, or hollow lines illustrate influences on performance driven by situational and task-organization factors. These are the most highly variable factors, which change from one collective task to another, and with each performance of a specific collective task.

Using the Model to Specify the Decision Rule for Factors

The conceptual model above was used to specify a decision rule for selecting factors for the unit type and collective task categorization schemes. We observed that the conceptual model contains three types of influences on collective task performance. The common element between these influences that determines performance is related to the proportion of the skills and knowledge needed to perform a collective task that a unit can currently bring to bear in performing the task.

Relationship to Unit Types and Collective Tasks. How does this relate to the characteristics of unit types and of collective tasks? Different unit types and collective tasks vary in the amount of skills and knowledge required for collective task performance. Some unit types have larger number of members and more complex organizational structures than other unit types. This influences the amount that unit members must learn and remember about their roles, relationships, and interactions with other unit members, in order to perform as a unit member. Soldiers in larger, more complex units have more to learn and remember to perform as unit members than do soldiers in smaller, less complex units.

Likewise, units adopt different task-organizations to perform different collective tasks. The unit's task-organization may require organization into sub-teams to accomplish different parts of the

¹ *I.e.*, tasks that have cognitive, psychomotor, and procedural components.

² Through collective skills loss as a result of ITI and turnover, as well as through the development of collective skills brought about by collective training.

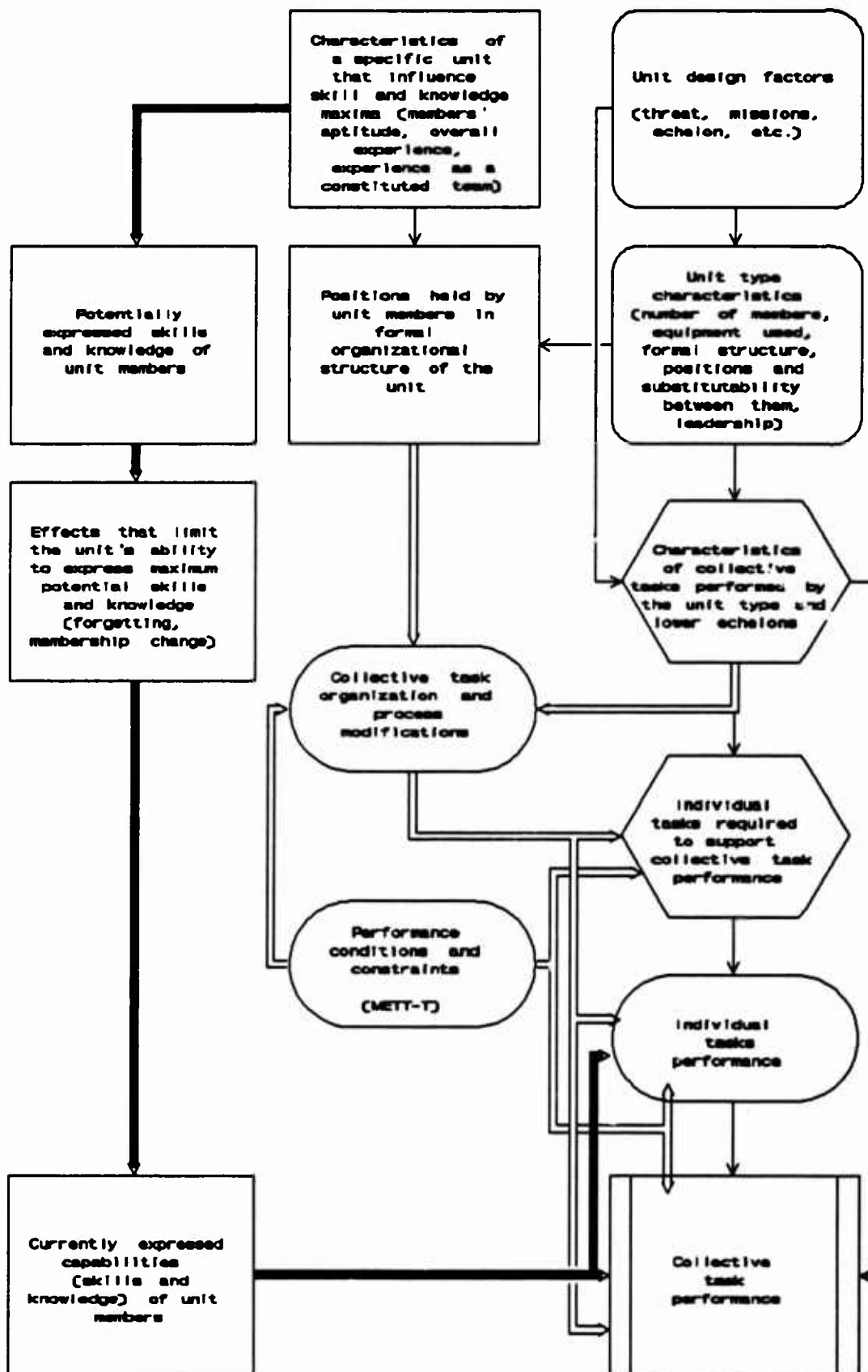


Figure 7. A conceptual model of factors that influence collective task performance.

collective task, to one extent or another. Different collective tasks may require that members perform different numbers and types of individual tasks to accomplish the task. Unit members interact and coordinate their activities in different ways, depending on the task-organization adopted for a particular collective task. The task-organization a unit adopts to perform a collective task specifies the roles and patterns of relationships and interactions that team members take on to perform the task. Each of these variables influences the amount that unit members must learn and remember in order to perform a collective task.

Relationship to Effects of ITI and Turnover. How does this relate to the effects of ITI and turnover on collective task performance? The more unit members have to learn and remember to perform either as a unit member, or to accomplish a specific collective task, the more there is to be forgotten during intervals without practice. Other factors being equal, the more there is to be forgotten, the larger the absolute amount that *will* be forgotten over a given ITI (Farr, 1986). The larger the absolute amount that is forgotten by unit members, the greater will be the effect on performance of collective skills loss (through forgetting).

With respect to the effects of turnover, all unit members require collective skills to perform as unit members and accomplish collective tasks. Because of the positions they occupy in the unit organizational structure, some members require larger amounts of collective skills, and perhaps different skills, than do others. For example, leaders may require more knowledge about how the unit organizes into sub-teams for a particular collective task, and how the sub-teams interact, than do non-leaders. When a unit member leaves the unit, there is a loss of needed collective skills to the unit at large. This results in a reduced level of collective task performance. The larger the proportion of unit members that leave a unit during a given time period, the larger the proportion of collective skills that are lost to the unit, and the greater the effect on performance.

The Decision Rule. Based on this reasoning, candidate factors identified in the literature were evaluated using the following decision rule:

"Does the factor influence the amount that unit members must learn and remember in order to accomplish (a) collective task(s)?"

Candidate factors that were judged to make a difference in the amount to be learned and remembered were tentatively adopted for use in the categorization scheme. Each factor was then considered further to develop hypotheses about the effects of the factor. These effects are expressed in terms of the effects of changes in the factor on the likely amount of collective skills loss due to forgetting and turnover.

Uses of the Categorization Schemes. Use of the decision rule above to screen factors for the categorization schemes means that these schemes can be used for potentially three purposes. The primary purpose, and the original reason for developing the schemes, is to predict collective skills retention under conditions of intervals without training and membership change. Since the evaluation of factors deals with the amount to be learned and remembered by unit members, the schemes may also be used to predict the relative amount of training needed to acquire collective skills for unit types and collective tasks. For the same reason, the schemes may also be related to the relative performance difficulty of collective tasks. Support for two of these three uses was found during validation of the unit type and collective task categorization schemes. This is further discussed in the next section of the report.

The Factors

Three sets of factors were selected as a result of the review of literature. One set of factors is used to predict the relative effects of ITI and turnover on collective task performance for different *unit types*. The second set of factors is used to predict the relative effects of ITI and turnover on the performance of specific *collective tasks*. The third set of factors can be used to predict the relative effects of time since training on the performance of *specific units* of a given type. Only the unit type and collective task schemes were applied in this research. The following paragraphs list the factors in each of the three sets, and present hypotheses about the effects of the factors on collective task performance, via forgetting and unit membership change.

Unit Type Factors. Seven factors were selected for predicting the relative effects of forgetting and turnover on collective task performance for unit types. They are:

1. **Number of unit members.** Larger units are predicted to experience more collective skills loss as a result of ITI, but less collective skills loss as a result of turnover, than smaller units. Larger units have a larger absolute amount to learn and remember, thus more absolute skill loss takes place for a given ITI than in small units. But, collective skills are distributed across more personnel in larger units than in small ones, resulting in less collective skill loss per person involved in turnover.
2. **Number of Sub-teams in Formal Unit Structure.** Units with larger numbers of formally-organized sub-teams will experience more collective skills loss as a result of both ITI and turnover than will units with fewer sub-teams. The more sub-teams in a unit type, the more there is for unit members to learn and remember about the different sub-teams, their membership, and the relationships and dependencies between the sub-teams. For unit types with more sub-teams, a larger absolute amount of information is lost per unit of ITI or turnover than is the case for units with fewer sub-teams.
3. **Position Redundancy in Formal Unit Structure.** This is a measure of the extent to which one unit member can directly substitute for other unit members (*i.e.*, occupies a position in the unit's organization with the same name). The greater the extent to which unit members can substitute for other unit members, the less the effect of either ITI or turnover on collective skills loss. Unit members that can substitute for one another may lose elements of collective skills at about the same rate with ITI, but probably do not lose the *same* elements. This means that most elements will be retained by at least some of the members, who can provide information to others holding similar positions. In this way, skills lost as a result of ITI can be quickly re-acquired. The extent to which members can substitute for others also reduces the effects of turnover. If others have essentially the same collective skills as unit members that leave the unit, then the skills are not lost to the unit altogether, and can be transferred to new members of a unit.
4. **Number of Equipment Items Used by the Unit Type.** Units that use larger numbers of different equipment items will experience more collective skills loss as a result of both ITI and turnover than units that use fewer equipment items. Each additional item of equipment adds knowledge and skills for using and maintaining

the item to the pool of information that the unit must learn and remember. This increases the absolute amount that must be learned and remembered by the unit at large and by individual unit members. Therefore, larger absolute amounts of information are lost per unit of ITI by units with more equipment items. The loss of each unit member to turnover also represents a loss of a larger amount of information, in units with larger amounts of equipment.

5. **Number of Collective Tasks Performed by Unit Type.** Units that perform larger numbers of collective tasks will experience more collective skills loss as a result of both ITI and turnover than will units that perform fewer collective tasks. Each collective task performed adds information about how the unit task-organizes for the task, how the task is performed, and how sub-teams interact to perform the task, to the pool of information the unit must learn and remember. This increases the absolute amount that must be learned and remembered by the unit at large and by individual unit members. Therefore, larger absolute amounts of information are lost per unit of ITI by units that perform more collective tasks. The loss of each unit member to turnover also represents a loss of a larger amount of information, in units that perform larger numbers of collective tasks.
6. **Number of MOS-Unique Individual Tasks Performed by Unit Members.** Units whose members perform larger numbers of individual tasks unique to their MOS will experience more collective skills loss as a result of both ITI and turnover than will units that perform fewer individual tasks. The rationale for this is identical to the rationale for the number of collective tasks factor.
7. **Number of Leaders in Formal Unit Structure.** Some collective skills are possessed only by personnel in leadership positions in a unit. Unit types with fewer leader positions in their structure will experience more collective skills loss with both ITI and turnover than unit types with more leaders. Individual leaders may lose elements of collective skills at about the same rate with ITI, but probably do not lose the *same* elements. This means that most elements will be retained by at least one of the leaders, who can provide information to other leaders. This can reduce the effects of collective skills loss due to ITI. Where there are more leaders, collective skills are distributed across more individuals. This results in a lower proportion of leader-specific collective skills loss per person leaving the unit due to turnover than when there are fewer leaders.

These factors can be evaluated for any unit type from information included in the Table of Organization and Equipment (TOE) and the AMTP for the unit type. As a convenient reference, these factors and the related hypotheses about the effects of ITI and turnover are summarized in Table 4.

Collective Task Factors. Six factors were selected for predicting the relative effects of ITI and turnover on task performance for specific collective tasks. Three of the factors for unit types are evaluated using rating scales (see Appendix E). They are:

1. **Number of Subtasks and Standards in AMTP Task Description.** This is analogous to the number-of-steps factor used by Rose, Radtke, Shettel, and Hagman (1985) in predicting the effect of time since training on performance for individual

Table 4

Summary of Factors in Unit Type Categorization Scheme

Factor	Hypothesized Effect of Factor on Collective Skills Loss	
	Effect Due to Inter-Training Interval	Effect Due to Turnover
Unit Size (Number of Members)	Larger size increases effect of ITI on skills loss	Larger size decreases effect of turnover on skills loss
Number of Sub-teams in Formal Unit Structure	Larger number of sub-teams increases effect of ITI on skills loss	Larger number of sub-teams increases effect of turnover on skills loss
Position Redundancy in Formal Unit Structure	Greater redundancy decreases effect of ITI on skills loss	Greater redundancy decreases effect of turnover on skills loss
Number Equipment Items Used by Unit Type	Larger number of equipment items increases effect of ITI on skills loss	Larger number of equipment items increases effect of turnover on skills loss
Number of Unique Collective Tasks Performed by Unit Type	Larger number of collective tasks increases effect of ITI on skills loss	Larger number of collective tasks increases effect of turnover on skills loss
Number of MOS-Unique Individual Tasks Performed by Unit Type	Larger number of individual tasks increases effect of ITI on skills loss	Larger number of individual tasks increases effect of turnover on skills loss
Number of Leaders in Formal Unit Structure	Larger number of leaders decreases effect of ITI on skills loss	Larger number of leaders decreases effect of turnover on skills loss

tasks. The performance of tasks that include more steps (subtasks and standards) will be more affected by both ITI and turnover than will tasks that include fewer steps. When there are more steps in a collective task, there is more for unit members to learn and remember in order to successfully perform the task. Therefore, a larger absolute amount of information is lost per unit ITI, and with each member that leaves a unit, for tasks with larger numbers of steps.

2. **Rating of Established *versus* Emergent Nature of Task Performance.** This factor is concerned with the amount of variation that is possible in performing a collective task. Established tasks are always performed in about the same way, regardless of the conditions under which the task is performed. Emergent tasks are performed differently, depending on the conditions of task performance. Emergent tasks usually have some sequence when they are performed, but the way in which the task is done can be very different from one occasion to another.

Collective skills loss for tasks that are rated as more emergent is more affected by ITI and turnover than is the case for tasks that are rated as more established. More emergent tasks may require knowledge about how to perform the task under many

different circumstances, plus decision rules for choosing how to perform the task. More established tasks may only require knowledge about the sequence of steps. Therefore, there may be a larger absolute amount to be learned and remembered in order to perform more emergent tasks. With a larger absolute amount to be learned and remembered, a larger absolute amount of collective skills loss occurs per unit of ITI, with more emergent tasks.

The information required for task performance in more emergent tasks also may be possessed by fewer unit members (likely leaders) than that required for more established tasks. The loss of one member possessing this information for more emergent tasks results in the loss of a larger proportion of the information than is the case for more established tasks. Therefore, the effects of turnover on collective skills loss are greater for more emergent than for more established tasks.

3. **Average Number of Sub-teams per AMTP Subtask.** This factor is concerned with the number of sub-teams into which a unit task-organizes to perform a collective task. Tasks where units divide into larger numbers of sub-teams will experience more collective skills loss as a result of both ITI and turnover than will tasks where fewer sub-teams are formed. The more sub-teams involved in performing a collective task, the more there is for unit members to learn and remember about the different sub-teams, their membership, and the relationships and dependencies between the sub-teams. For collective tasks involving more sub-teams, a larger absolute amount of information is lost per unit of ITI or turnover than is the case for tasks involving fewer sub-teams.
4. **Number of MOS-Unique Individual Tasks Required in Performing Collective Task.** Collective tasks that involve performing larger numbers of individual tasks will experience more skills loss as a result of both ITI and turnover than will collective tasks that involve fewer individual tasks. Each individual task performed adds information about when, by which members, and how the task is performed in context of the collective task, to the pool of information unit members must learn and remember. This increases the absolute amount that must be learned and remembered by the unit at large and by individual unit members. Therefore, larger absolute amounts of information are lost per unit of ITI for collective tasks that involve performing more individual tasks. The loss of each unit member to turnover also represents a loss of a larger amount of information, for collective tasks that involve performing larger numbers of individual tasks.
5. **Rating of Coactive *versus* Interactive Nature of Task Performance.** Coactive tasks are those where unit members all do qualitatively the same or very similar activities throughout performance of the task, under more or less centralized direction. Interactive tasks are those where different unit members or sub-teams do qualitatively different activities at the same time during task performance, with multi-directional communication between unit members who do different activities. Collective tasks that are rated as more interactive experience more collective skills loss due to ITI and turnover than those that are rated more coactive. Performing interactive tasks requires that unit members learn and remember information about the task-organization of the unit, the division of responsibilities between unit members and sub-teams performing different types of activities, and task-specific

communication patterns and modes. Coactive tasks involve much less to learn and remember. Therefore, both ITI and turnover result in larger amounts of collective skill loss for collective tasks that are rated as more interactive.

6. **Rating of Potential for Compensating for or Correcting Errors in Task Performance.** Collective tasks differ in the extent to which unit members can compensate for inadequate performance on the part of other members, and to which leaders can correct errors by redirecting task performance. Collective tasks where the potential for compensation or correction in task performance is less will experience greater effects on performance as a result of both ITI and turnover than will tasks where the potential for compensation or correction is greater. This is because compensating for or correcting task performance errors tends to counter the deterioration in performance that results from collective skills loss.

These factors are evaluated for collective tasks from analyses of the collective task descriptions that appear in T&EOs in the AMTPs. A summary of the factors and hypotheses about how they affect collective skills loss via ITI and turnover is presented in Table 5.

Table 5
Factors in Collective Task Categorization Scheme

Factor	Hypothesized Effect of Factor on Collective Skills Loss	
	Effect Due to Inter-Training Interval	Effect Due to Turnover
Number of Subtasks and Standards	Larger number of steps increases effect of ITI on skills loss	Larger number of steps increases effect of turnover on skills loss
Established <i>versus</i> Emergent Rating of Task	More emergent rating indicates larger effect of ITI on skills loss	More emergent rating indicates larger effect of turnover on skills loss
Average Number of Sub-teams per Subtask	Larger number of sub-teams per subtask increases effect of ITI on skills loss	Larger number of sub-teams per subtask increases effect of turnover on skills loss
Number of MOS-Unique Individual Tasks Performed	Larger number of individual tasks increases effect of ITI on skills loss	Larger number of individual tasks increases effect of turnover on skills loss
Coactive <i>versus</i> Interactive Rating of Task	More interactive rating indicates larger effect of ITI on skills loss	More interactive rating indicates larger effect of turnover on skills loss
Rating of Potential for Compensation or Correction	Less rated potential indicates larger effect of ITI on skills loss	Less rated potential indicates larger effect of turnover on skills loss

Specific-Team Factors. Three factors were selected for predicting the relative effects of time since training on collective task performance for specific units (*i.e.*, Second Platoon, B Company). Although these factors were not applied in this research, they are presented here for completeness. The factors are:

1. **Aptitude.** Units whose members possess higher general aptitude, as measured by the Armed Forces Qualification Test (AFQT), will experience less collective skills loss per unit ITI than will unit having lower-aptitude members. Higher-aptitude personnel typically learn to criterion more rapidly and retain more learned material over a given ITI (Hall, Ford, Whytten, and Plant, 1983; Vineberg, 1975; Black, 1980). A measure for this factor should reflect both the average level of aptitude in a unit and the highest level of aptitude among unit members (Williams and Sternberg, no date).
2. **Turnover Rate.** This factor reflects the experience of unit members in performing collective tasks as a constituted unit. It therefore is an indirect measure of the extent to which unit members *may have* acquired collective skills through working together as a unit. Higher turnover rates are associated with lower levels of potential for acquiring collective skills. If fewer collective skills have been acquired by unit members, the effect on performance is similar to that produced through forgetting.
3. **Overall Experience.** As a result of experience in performing collective tasks as a member of many units, soldiers may overlearn some components of collective skills. Such overlearning makes the learned skills highly resistant to forgetting (Farr, 1986; Lane, 1986). We propose that the overall experience of unit members as soldiers reflects the extent to which this takes place. More experienced unit members may have overlearned more collective skills components and, hence, have greater resistance to forgetting them. This means that units with more experienced members, overall, may be less affected by collective skills loss as a result of ITI. A measure for this factor should reflect both the average level of experience among unit members and the highest level of experience in the unit.

As mentioned, these factors were not applied in the research. A possible use of these factors, or some combination of them, would be to identify units that most require training to develop collective skills. Lower aptitude, higher turnover rates, or less overall experience may indicate units that are more in need of training to build collective skills, or that will be more affected by ITI and should therefore train more often.

Applying the Factors

After the factors were selected, procedures for applying each factor to categorize unit types or collective tasks were developed. The procedures for applying the unit type factors are straightforward. They require only counting quantities in TOEs and AMTPs, and simple arithmetic. More elaborate procedures had to be developed for applying the collective task factors. Three of the collective task factors required the development of rating scales (*Established versus Emergent*, *Coactive versus Interactive*, and *Potential for Correction or Compensation in Task Performance*). A fourth factor (*Average Number of Sub-teams per Subtask*) required specific instructions and examples

for application. The instructions for applying each factor to categorize unit types and collective tasks are presented in Appendix E.

Unit Type Factors. The unit type factors were applied to evaluate eight unit types on each factor. These included the five unit types listed above, plus the following unit types:

1. Tank crews;
2. MLRS Firing Sections; and
3. MLRS Firing Platoons.

Behavioral scientists who were familiar with the unit types evaluated the seven unit type factors, using the data sources for each unit type suggested in Appendix E. Raw scores from evaluating the unit type factors are presented in Table F-1, Appendix F.

To simplify using and interpreting the predictions about the effects of ITI and turnover on collective skills loss, the raw scoring data for unit type factors were converted into "high" and "low" effects indexes. We did this by examining the distributions of each of the seven factors separately, and dividing them at the median. For each factor, unit types that were above the distribution median (with respect to the hypotheses above about the effects of the factor) were declared to have a "high" effect of ITI, turnover, or both. Unit types that were below the median were declared to have a "low" effect of ITI, turnover, or both. The results of this conversion are presented in Table F-2, Appendix F, for the eight unit types.

We then combined the predictions about the effects of the seven separate factors to give an index of the overall predicted effects of ITI and turnover for each unit type. This was done by counting the number of times each unit type was declared to have a "high" effect with respect to ITI or turnover. This gave a number ranging from 0 to 12. (The hypotheses about the effects of the number-of-members factor on ITI and turnover are contradictory. This factor therefore does not contribute to the unit-type effect index. This is why the index score cannot be more than 12.) We interpret this number as a prediction of the *relative* amount of effect on collective skills loss of ITI and turnover for a unit type. It is an ordinal number. The results of combining the effect predictions for the separate factors are given for the eight unit types in Figure F-3, Appendix F. We will subsequently refer to these numbers as Unit Type Effect Predictions, or UTEP. In practical terms, we predict that the larger the UTEP score assigned to a unit type, the larger will be the effects on the performance of the unit type of collective skills loss as a combined result of ITI and turnover. This means that unit types that receive larger UTEP scores may need more frequent practice to sustain collective skills, once the skills are initially acquired. In accordance with the other interpretations of the unit type categorization scheme, larger UTEP scores for unit types can also mean that more training may be necessary to initially develop collective skills, and that collective performance overall may be more difficult for a unit type.

Collective Task Factors. We used a similar process to evaluate the collective task factors. Only collective tasks performed by the five unit types of primary interest were evaluated. As mentioned earlier, only a subset of the tasks listed in the AMTPs for these five unit types were evaluated. This is because the task descriptions in the AMTPs for some tasks were not sufficiently clear or detailed for applying all six collective-task factors. The tasks that were excluded for this reason are listed in Appendix A for each unit type.

SMEs who were familiar with the unit types and the collective tasks they perform evaluated each factor for the collective tasks. These were some of the same SMEs that performed the estimation task discussed earlier. Referring back to Table 2, the SME listed as #1 evaluated the factors for Armor Platoon Tasks. SME #3 evaluated the factors for Mechanized Infantry Platoon and Squad Tasks. SME #5 evaluated the factors for Light Infantry Platoon and Squad tasks. Raw data from the evaluation of the factors for each task is presented in tables in Appendix F. A cross-reference of unit types and the Appendix F tables in which these raw data are found is presented in Table 6. This Table also cross-references the Appendix F tables where summary "high" and "low" scoring for each factor, and combined collective skill loss predictions for collective tasks, are found. Developing this scoring is discussed in the next two paragraphs.

Table 6

Cross-Reference for Collective Task Factor Evaluation Data

Unit Type	Raw Scoring Data	"High" and "Low" Summary Data	Combined ITI and Turnover Effect
Light Infantry Platoon	Table F-4	Table F-5	Table F-6
Mechanized Infantry Platoon	Table F-7	Table F-8	Table F-9
Armor Platoon	Table F-10	Table F-11	Table F-12
Light Infantry Squad	Table F-13	Table F-14	Table F-15
Mechanized Infantry Squad	Table F-16	Table F-17	Table F-18

We developed summary "high" and "low" judgments about the collective task factor scores in the same way as for unit types. However, the score distributions for collective tasks for each unit type were developed and examined separately. The "cutpoints" for dividing the distribution for each factor into "high" and "low" regions were also chosen separately for collective tasks for each unit type. This was done so as to initially have the unit type and collective task factors be scored as independently as possible. "Cutpoints" for the factors were always values near the median of the distributions. We sometimes deviated from the exact median to avoid assigning the same numerical score on a factor to both "high" and "low" effect categories. The same "cutpoint" values were used across all unit types for four of the factors: Number of Subtasks and Standards; Established *versus* Emergent rating; Coactive *versus* Interactive rating, and rating of Potential for Compensation or Correction. Different "cutpoints" were used for each unit type for the factors Number of Sub-teams per Subtask and Number of Individual tasks. For the latter two factors, the distributions of raw scores were very different from unit type to unit type. On the other four factors, the distributions were similar across unit types. The "high" and "low" effect declarations for ITI and turnover for each collective task are given in the Appendix F tables referred to in Table 6.

The "high" and "low" declarations for the separate collective task factors were combined to give an index of the overall predicted effects of ITI and turnover for each collective task. This was done by counting the number of times each unit type was declared to have a "high" effect with respect to ITI or turnover. This gave a number ranging from 0 to 12. We interpret this number as a

prediction of the *relative* amount of effect on collective skills loss of ITI and turnover for a collective task. It is an ordinal number. The results of combining the effect predictions for the separate factors are given in the Appendix F tables referenced in Table 6. These numbers will be referred to in the rest of this report as Collective Task Effect Predictions, or CTEP. In practical terms, we predict that the larger the CTEP score assigned to a collective task, the larger will be the effects on task performance of collective skills loss as a combined result of ITI and turnover. This means that collective tasks assigned higher CTEP scores may require more frequent retraining to sustain the collective skills needed for proficient task performance. It can also mean that collective tasks assigned higher CTEP scores are more difficult to perform, or require more training to initially develop needed task-specific collective skills.

Validating the Predictions from the Categorization Schemes

Individual-factor evaluations from both the unit type and collective task categorization schemes, and the UTEP and CTEP scores assigned to unit types and collective tasks, were validated against SME estimates of collective task performance change. Evaluations of collective-task and CTEP scores assigned to Light Infantry Platoon tasks were also validated against actual task performance data. This subsection describes how the validations were performed.

Unit-type Factors and UTEP Validation

We validated the individual-factor evaluations and the UTEP for each unit type against components of the regression equations that describe collective skills loss. This allowed us to compare the factors and the UTEP prediction against four different effects that were included in the regression equations:

1. Collective skills loss (and performance decrement) associated with ITI;
2. Collective skills loss (and performance decrement) associated with turnover among non-leader unit members;
3. Collective skills loss (and performance decrement) associated with turnover among junior leaders in units; and
4. Collective skills loss (and performance decrement) associated with turnover among senior leaders in units.

To make these comparisons, we calculated the average B weight from the regression equations for each of the four effects listed above, across all collective tasks performed by each unit type, separately. This gave a measure of the strength of each of the four effects for a unit type. These four values were then correlated with the *raw data* values for each unit-type factor, and with the UTEP score assigned to unit types. Because we did not have SME performance estimate data on all eight unit types that were evaluated on the unit-type categorization scheme, only the five unit types listed earlier in this section were part of the analyses. Table 7 summarizes the analyses that were performed.

Table 7

Summary of Analysis to Validate Unit Type Categorization Scheme

Each of These Unit Type Classification Factors		Each of These Characteristics of Regression Equations Based on SME Estimates
UTEF Score		
Number of Members Number of Sub-teams Position Redundancy Measure No. of Equipment Items per Member Number of Collective Tasks Number of Individual tasks Number of Leaders	was correlated against	Average B Weight for Effect of ITI Average B Weight for Effect of Non-leader Turnover Average B Weight for Effect of Junior Leader Turnover Average B Weight for Effect of Senior Leader Turnover

Collective-Task Factors and CTEP Validation Against SME Estimate Data

A similar analysis was performed to validate the collective-task factors and the CTEP value assigned to each collective task. In these analyses, B weights from the regression equations for each collective task were correlated against the raw data for each collective-task factor, and the CTEP value assigned to the task. Separate analyses were made for each of the five unit types. Table 8 summarizes the analyses performed.

Collective-Task Factors and CTEP Validation Against Actual Performance Data

The isolated collective-task factors and the CTEP assigned to collective tasks were also validated against actual Light Infantry Platoon task performance. The performance data used for validation were derived from records of Light Infantry Platoons' performance during rotations to the Joint Readiness Training Center (JRTC). Performance data were obtained from 12 unit rotations to the JRTC, and Light Infantry Platoon performance data were extracted from the master data sets for analysis. A total of 1766 Platoon collective task performances were available across the 12 rotations. Of these, only 1230 corresponded to collective tasks for which collective-task factor evaluations and CTEP are available. These 1230 task performances were the criterion data set for our analyses.

Two performance variables were derived. The first, derived for all 1230 task performances, is simply the ratio of task steps scored as "GO" over those evaluated for a task performance. Scores on this variable can range from 0 to 1. The second performance variable differentially weights

Table 8

Summary of Analyses to Validate Collective Task Categorization Scheme

For Each Unit Type Separately,		
Each of These Collective Task Classification Factors	was correlated against	Each of These Components of Regression Equations Based on SME Estimates
CTEP Score		B Weight for Effect of ITI
Number of Subtasks & Standards		B Weight for Effect of Non-leader Turnover
Established <i>versus</i> Emergent Rating		B Weight for Effect of Junior Leader Turnover
Number of Sub-teams per Subtask		B Weight for Effect of Senior Leader Turnover
Number of Individual Tasks		
Coactive <i>versus</i> Interactive Rating		
Rating of Potential for Correction or Compensation in Task Performance		

subtasks that are critical, or are leader subtasks (per T&EO task descriptions). Subtasks that are both critical and leader subtasks were assigned a weight of 4, if scored "GO." Subtasks that are only leader subtasks, or only critical, were assigned a weight of 2, if scored "GO." "Ordinary" subtasks were assigned a weight of 1, if scored "GO." Subtasks scored "NO GO" were assigned a weight of zero. The subtask weights for each task performance were summed, and the sum divided by the number of subtasks scored. Values on this variable can range from 0 to 4. Because of missing information about whether subtasks were critical or leader subtasks, the weighted performance variable was derived for only 859 task performances. Table 9 shows the collective tasks included in the analyses for the two performance variables, and the number of task performances included for each variable, by task.

We performed two different analyses using these data. The first analysis used median tests (Siegel, 1956), using CTEP and the "high" *versus* "low" declarations on each of the six isolated collective task factors as grouping variables, in separate analyses. The objective of these statistical tests was to determine whether there are relationships between the CTEP and the isolated collective-task factors on the one hand, and task performance on the other. We expected to find that larger values of CTEP, and "high" effect declarations on isolated collective-task factors, would be related to lower levels of collective task performance.

We also computed correlations between the CTEP scores for collective tasks and the performance variables. The correlations supplement the results of median tests by providing an estimate of the strength of the relationship between CTEP and the performance scores.

Table 9**Tasks Included in JRTC Validation Database Analyses**

Task Title	Number of Cases for Unweighted Variable	Number of Cases for Weighted Variable
Conduct Helicopter Movement	113	111
Perform Raid	23	4
Perform Point Ambush	57	17
Overwatch/Support by Fire	23	9
Occupy Patrol Base	108	104
Conduct Passage of Lines	6	—
Perform Linkup	49	13
Infiltrate/Exfiltrate	43	14
Occupy Assembly Area	90	44
Breach Obstacles	25	24
Assault	93	93
Move Tactically	251	194
Reconnoiter Area	28	28
Reconnoiter Zone	23	23
Reconnoiter Route	2	2
Clear Trench Line	5	5
Knock Out Bunker	21	21
Occupy Objective Rally Point	34	11
Perform Anti-Armor Ambush	6	—
Perform Hasty Ambush	6	5
Occupy OP/Perform Surveillance	33	33
Employ Fire Support	122	49
Construct Obstacles	38	37
Perform Area Ambush	11	4
Conduct Aerial Resupply	10	4
Defend Against Air Attack	10	10
TOTAL	1230	859

Analyses of JRTC Data Against SME Data. The Light Infantry Platoon JRTC performance data were also compared to predictions using the SME-based regression equations. For the collective tasks on which JRTC performance data were available, we computed a performance prediction using the regression equation for each task. The same ITI and turnover values were used to compute the prediction for each collective task. For the computations, the ITI used was three months, and turnover was 33 percent in each of the three personnel categories. We correlated the performance predictions from the regression equations with both the unweighted and weighted JRTC performance measures for the same tasks. This gave an estimate of the agreement between JRTC performance data and the SME estimates.

Analyses to Explore Simplifying User Guidance

As mentioned earlier, one of the purposes of developing the categorization schemes for collective tasks was to attempt to simplify user guidance for applying predictions from the regression equations. If the same regression equation can be used to make predictions for more than one task, it can reduce the amount of information that must be presented to unit training planners, making the guidance more simple to use. We performed a series of analyses to determine if this is possible.

Discriminant Analysis. We hypothesized that the numeric scores provided by the CTEP and the isolated collective-task factors could provide a rationale for using the same regression equation for multiple tasks. To test whether this was the case, we performed discriminant analyses using the CTEP scores and isolated factor "high" and "low" declarations for the six collective-task factors as grouping variables. The analyses used the B weights for ITI and the three turnover variables from the regression equations as predictor variables. The analyses were performed for the collective tasks of each unit type separately. Thirty-five analyses were performed (seven for each of five unit types). Only one discriminant function was computed in each analysis, because interpreting results is sometimes difficult when more than one discriminant function is computed.

Predictor variables were not forced into the discriminant function equations. They were added to each equation in a stepwise fashion, based on making a statistically significant increase in the amount of variance accounted for between groups (as defined by the grouping variable in use).

Collective task group membership, as predicted by the discriminant function computed in each analysis, was computed and compared with actual group membership established by the grouping variable in use in the analysis. Of special interest was the overall proportion of collective tasks placed in the "correct" grouping categories by each discriminant function. This provides a simple decision rule as to whether the same regression equation can be used for the collective tasks in each category, as defined by the CTEP score or an isolated collective-task factor. The predictor variables that contributed to each discriminant function were also identified and examined for all 35 analyses.

Cluster Analyses. We also used another analytic approach to determine whether it is possible to predict collective skills loss for more than one collective task using the same regression equation. This was cluster analysis. This procedure was used to identify similarities between the regression equations for collective tasks for each unit type, without considering the CTEP score categories or "high" and "low" declarations on the isolated collective-task factors. The regression equation B weights for ITI and the three turnover personnel categories were used as predictor variables for these analyses. In this case, all four predictor variables were forced into each analysis, because we wanted

to examine the total similarities between the regression equations for different collective tasks. Collective tasks for each of the five unit types were analyzed separately.

The cluster analyses were followed-up by making and comparing plots of predicted performance for pairs of tasks that were identified as having similar regression equations by the cluster analysis procedure. This provided a "common sense" evaluation of the results of the statistical comparison between regression equations made by the cluster analysis procedure.

RESULTS

This section of the report discusses the regression equations developed to predict collective skills loss and collective task performance. Also in this section are the results of validating the unit-type and collective-task categorization schemes.

The Regression Equations

For all 235 tasks, linear regression equations were adequate to describe the data. That is, no exponential or power terms were needed to account for the maximum amount of variance between the SME performance estimates and the predictor variables. This is shown by the achieved multiple

Table 10

Selected Statistics of Coefficients of Multiple Correlation for Regression Equations

Unit Type	Average Multiple <i>r</i>	Minimum Multiple <i>r</i>	Maximum Multiple <i>r</i>
Armor Platoon	.98	.93	.99
Mechanized Infantry Platoon	.98	.94	.99
Light Infantry Platoon	.96	.59	.99
Light Infantry Squad	.97	.82	.99
Mechanized Infantry Squad	.99	.96	.99

correlation values in Table 10. The regression equations follow the general model in Equation 1.

$$\hat{Y}_P = C + B_I x_I + B_S x_S + B_J x_J + B_M x_M \quad \text{Eq. 1}$$

In this equation, \hat{Y}_P represents the predicted performance of a unit on a collective task. This can be thought of as the probability that the unit will be evaluated as Trained, or "1" if it performs the task under the existing conditions of ITI and turnover. The term C is the regression equation constant. The B terms are the weights, or coefficients, that are applied to raw ITI and turnover data to make the performance prediction. B_I is the weight for ITI, B_S is the weight for senior leader turnover, B_J is the weight for junior leader turnover, and B_M is the weight for non-leader unit

member turnover. The x terms in the equation are the ITI and turnover data that are used to make the performance prediction. x_i represents the value of ITI, and should be expressed in months, as an integer. x_s , x_j , and x_M are respectively the values of turnover for senior leaders, junior leaders, and non-leader unit members. These should be expressed as decimal percentages (*i.e.*, 33 percent turnover should be expressed as .33). Equation 2 gives an example of applying the general equation model shown in Equation 1. Here, we use the equation for the collective task Clear Building, Performed by Light Infantry Platoons. For this example, we assume an ITI of four months, and turnover of 50 percent, 30 percent, and 50 percent among senior leaders, junior leaders, and non-leader unit members, respectively. Predicted performance (\hat{Y}_p) is .86932.

$$\begin{aligned}\hat{Y}_p &= 1.03975 + (-.01858)(4) + (-.03503)(.5) + (-.13565)(.3) + (-.07581)(.5) \\ \hat{Y}_p &= 1.03975 + [(-.07432) + (-.01752) + (-.04069) + (-.03790)] \\ \hat{Y}_p &= 1.03975 - .17043 \\ \hat{Y}_p &= .86932\end{aligned}\quad \text{Eq. 2}$$

The regression constant C and B weight coefficients for the equations for each collective task are found in tables in Appendix G. Note that all B weights in these tables have negative signs—they represent performance *decrements* as a result of ITI and turnover. This is as expected. The coefficient of multiple regression R^2 is also given for each collective task in these tables. At the end of the columns for turnover B weights in the tables are the largest valid values for turnover that should be used with the equations for a unit type's collective tasks. These are the largest percentage values for turnover in each personnel category that were included in the SME estimation task scenarios. They represent total turnover for a personnel category, rather than a turnover rate. For example, if 60 percent turnover were listed as the largest valid value for a personnel category, then the regression equations in the table should be used to predict collective task performance for no more than 60 percent total turnover for that personnel category during the ITI of interest.

Plots from applying the regression equations for all 235 tasks are presented in Appendix H. These are included to allow visual comparison of the differences in the effects of ITI and turnover between tasks. Plots are shown for 5, 10, 15, 20, and 25 percent *per month* turnover rates, and 1 to 6 month ITIs, in Appendix H. The plots for the 15 percent turnover rate are shown out to only four months, and the plots for the 20 and 25 percent rates are shown only out to three and two months, respectively. This is because of the limited amount of total turnover that was included in the SME estimation scenarios. An example plot is shown in Figure 8.

Evaluation of Terms Absent in Some Equations

While a majority of the regression equations contain all five terms shown in Equation 1, in some cases equations contain fewer terms. The "missing" terms are always one or more of the turnover-effect terms. All equations contain a term for ITI. We examined the equations with "missing" terms, and the collective tasks with which they are associated, to attempt to find reasons for this. The tasks for each unit type that had "missing" terms are listed in Table 11.

We examined the differences between terms that *were* included in the equations. The equations for each unit type were divided into sets of paired groups: those that contained the term that was "missing" in others, and those that lacked a particular term (*e.g.*, a term for the effect of

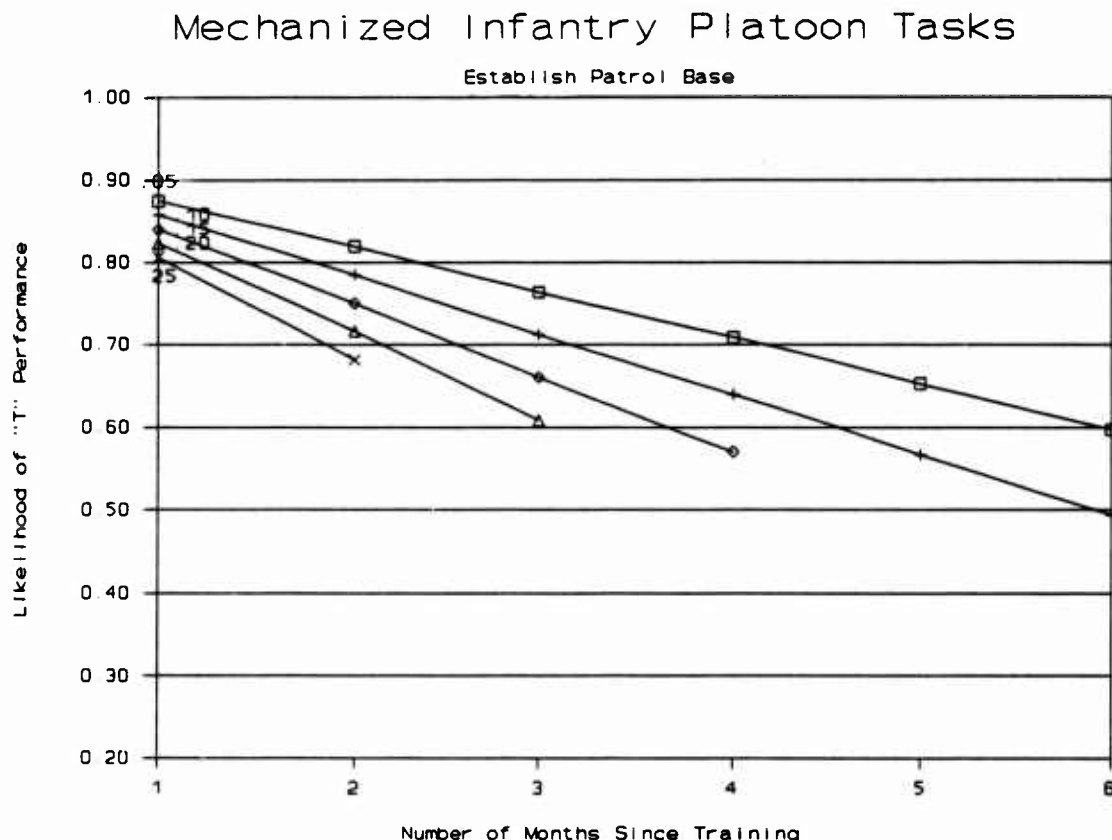


Figure 8. Example plot of predictions from regression equations.

senior leader turnover). We then computed means and standard deviations for each term that was *present* in the equations of both groups (*i.e.*, for all but the "missing" term), and performed *t*-tests to determine if the means differed. The results are summarized in Table 12.

For collective tasks performed by Armor Platoons, the equations for three of the 64 tasks lacked a term for *non-leader member turnover*. Compared with the 61 equations that contained a non-leader turnover term, these equations contain larger effects due to senior leader turnover and ITI.

Twenty-four of the 58 equations for Mechanized Infantry Platoon collective tasks lacked a term for *non-leader member turnover*. No statistically reliable differences in other equation terms were found between the 34 equations containing non-leader turnover terms and those that did not contain such terms.

For collective tasks performed by Light Infantry Platoons, the equations for 13 of 45 tasks lacked a term for *non-leader member turnover*. These differed from the equations for the 32 tasks that did contain such terms, in that tasks without non-leader turnover terms had smaller regression constants and smaller effects due to ITI. The equations for four collective tasks performed by Light Infantry Platoons lacked terms for *senior leader turnover*. Compared to equations for the 41 tasks that did contain such terms, these four equations contain somewhat larger effects due to non-leader

Table 11

Collective Tasks Whose Equations Do Not Contain All Possible Terms

Unit Type	Term "Missing"	Tasks for Whose Equations the Term is "Missing"
Armor Platoon	Non-Leader Member Turnover	Perform Tactical Planning Perform Precombat Checks Rehearse Mission
Mechanized Infantry Platoon	Non-Leader Member Turnover	<div> Dismounted Mounted Column Formation (Mounted) Conduct Aerial Resupply Conduct Anti-Armor Ambush Conduct Fire and Movement Conduct Point Ambush Conduct Screen/Guard Operations Disengage (Mounted) Emplace Hasty Protective Minefield Establish Objective Rally Point Establish Patrol Base </div> <div> Knock Out Bunker Maintain Operations Security Prepare for Combat React to Ambush React to Contact React to Direct Fire/ATGM React to Nuclear Attack Reconnaissance and Security Reconnoiter Objective Reconnoiter Zone Report Support by Fire </div>
Light Infantry Platoon	Non-Leader Member Turnover	<div> Assault Consolidate and Reorganize Defend Against Air Attack Occupy Objective Rally Point Perform Aerial Resupply Perform Boat Movement Perform Helicopter Movement </div> <div> Prepare for Chemical Attack Prepare for Combat Prepare for Nuclear Attack Reconnoiter Area Reconnoiter Zone Sustain </div>
	Senior Leader Turnover	<div> Clear Trench Line Occupy Assembly Area Perform Link-up Prepare for Nuclear Attack </div>
Light Infantry Squad	Non-Leader Member Turnover	<div> Consolidate and Reorganize Defend Against Air Attack Perform Boat Movement Perform Tactical Road March Prepare for Combat </div>
	Junior Leader Turnover	<div> Assault Occupy Assembly Area </div>
	Senior Leader Turnover	<div> Defend Against Air Attack Disengage Maintain Operations Security Perform a Passage of Lines Perform Tactical Road March </div>
Mechanized Infantry Squad	Non-Leader Member Turnover	<div> Conduct Aerial Resupply Conduct Anti-Armor Ambush Conduct Helicopter Movement Conduct a Passage of Lines Establish Objective Rally Point Plan & Control Combat Operations Reconnoiter Objective </div>

turnover and ITI, but somewhat smaller effects due to junior leader turnover.

Five of the 38 equations for collective tasks performed by Light Infantry Squads lacked terms for *non-leader member turnover*. Compared to the other 33 equations, these five contained smaller regression constants and smaller effects due to ITI. Five equations for Light Infantry Squad collective tasks lacked *senior leader turnover* terms. The other terms in these equations did not differ statistically from the corresponding terms in the other 33 equations. Two equations for Light Infantry Squad collective tasks lacked *junior leader turnover* terms. The terms in these equations were no

Table 12

Statistical Comparison of Regression Equation Terms—"Missing" Terms Equations

Unit Type	Term "Missing"	Term *	Statistics for Tasks Whose Equations Have Term		Statistics for Tasks Whose Equations Lack Term		Value of <i>t</i>	Significance of <i>t</i>
			Mean	s.d.	Mean	s.d.		
Armor Platoon	Non-leader Member Turnover	C	.9786	.038	.9384	.030	1.82	N/s
		S	-.2044	.073	-.3071	.090	2.35	.022
		I	-.0287	.008	-.0398	.016	2.14	.036
Mechanized Infantry Platoon	Non-leader Member Turnover	C	.9639	.036	.9501	.024	1.75	N/S
		S	-.2415	.100	-.2714	.051	1.34	N/S
		J	-.1086	.041	-.1092	.033	0.06	N/S
		I	-.0420	.013	-.0390	.010	-0.95	N/S
Light Infantry Platoon	Non-leader Member Turnover	C	1.0453	.014	1.0275	.006	4.29	< .001
		S	-.0456	.023	-.0462	.024	0.07	N/S
		J	-.0991	.024	-.0925	.017	-0.90	N/S
		I	-.0224	.009	-.0171	.005	-2.80	.008
	Senior Leader Turnover	C	1.0398	.015	1.0432	.019	-0.43	N/S
		J	-.0990	.022	-.0779	.010	-3.43	.013
		M	-.0596	.029	-.0895	.028	1.70	N/S
		I	-.0218	.008	-.0273	.010	1.23	N/S
Light Infantry Squad	Non-leader Member Turnover	C	1.0397	.012	1.0224	.011	3.09	.004
		S	-.0493	.013	-.0479	.011	-0.18	N/S
		J	-.0690	.030	-.0708	.031	0.12	N/S
		I	-.0300	.005	-.0113	.005	-3.56	.001
	Senior Leader Turnover	C	1.0384	.012	1.0310	.016	1.20	N/S
		J	-.0723	.029	-.0503	.030	-1.55	N/S
		M	-.1032	.036	-.0962	.057	-0.31	N/S
		I	-.0193	.006	-.0159	.008	-1.22	N/S
	Junior Leader Turnover	C	1.0371	.013	1.0425	.010	-0.58	N/S
		S	-.0496	.013	-.0427	.006	-.74	N/S
		M	-.1006	.037	-.1331	.035	1.22	N/S
		I	-.0188	.006	-.0204	.007	0.38	N/S
Mechanized Infantry Squad	Non-leader Member Turnover	C	.9368	.042	.9476	.022	-.66	N/S
		S	-.0544	.021	-.0563	.017	0.22	N/S
		J	-.0458	.023	-.0384	.013	-.81	N/S
		I	-.0399	.052	-.0281	.006	-.59	N/S

* C—constant; S—Senior Leader; J—Junior Leader; M—Non-leader; I—I/TI

different than the corresponding terms in the remaining 36 equations.

Seven of 30 Mechanized Infantry Squad tasks' equations lacked terms for *non-leader member turnover*. The terms contained in these equations were not statistically different from the corresponding terms in the other 23 equations.

Examining the specific tasks for which regression equation terms were "missing" across unit types, along with the statistical results above, we speculated that tasks where non-leader member terms were lacking might be those where leadership tasks are of paramount importance. Logically, these should be the tasks on which leader turnover would have a larger effect on collective skills loss and on performance. This speculation was reinforced when we examined the specific tasks that lacked senior or junior leader terms. To test this hypothesis, we compared the proportion of "leader" subtasks described in the T&EOs between collective tasks whose equations contained particular terms, and the tasks whose equations lacked the terms. Table 13 summarizes the results.

Table 13

Tests of the Proportion of "Leader" Subtasks for Equations With and Without Turnover Terms

Unit Type	Term "Missing"	Proportion of "Leader" Subtasks for Equations Containing Term	Proportion of "Leader" Subtasks for Equations <i>Not</i> Containing Term	t-test statistic	Significance
Armor Platoon	Non-leader Turnover	.42	1.00	not testable	would be < .001
Mechanized Infantry Platoon	Non-leader Turnover	.45	.53	1.14 (d.f. = 56)	> .10
Light Infantry Platoon	Non-leader Turnover	.42	.52	3.32 (d.f. = 43)	< .01
	Senior Leader Turnover	.46	.43	0.40 (d.f. = 43)	N/S
Light Infantry Squad	Non-leader Turnover	.43	.44	0.14 (d.f. = 36)	N/S
	Senior Leader Turnover	.44	.41	0.36 (d.f. = 36)	N/S
	Junior Leader Turnover	.44	1	1.75 (d.f. = 36)	< .05
Mechanized Infantry Squad	Non-leader Turnover	.35	.65	2.78 (d.f. = 28)	< .01

While not completely consistent, the results in Table 13 support the hypothesis that equations for tasks that *do not* contain non-leader member turnover terms, and those that *do* contain leader turnover terms, are related to higher proportions of "leader" subtasks contained in the collective task. We believe that this means that SMEs are able to consistently and correctly differentiate between leader and non-leader turnover effects on collective task performance. This supports the validity of using the SME estimation approach for identifying the effects of turnover on collective task performance.

ITI Effects in the Equations

Table 14 presents statistics that describe the regression equation constants and B weight coefficients for ITI and turnover in the three personnel categories in regression equations, for each unit type.

Table 14
Descriptive Statistics of Regression Equation Terms for Five Unit Types

Unit Type	Statistic	Equation Term				
		Constant	B Weight for ITI	B Weight for Senior Leader Turnover	B Weight for Junior leader Turnover	B Weight for Non-leader Turnover
Armor Platoon	Mean	.9767	-.0292	-.2093	N/A	-.0905
	s.d.	.0381	.0090	.0764	N/A	.0290
Mechanized Infantry Platoon	Mean	.9582	-.0407	-.2539	-.1089	-.0651
	s.d.	.0321	.0118	.0842	.0378	.0326
Light Infantry Platoon	Mean	1.0401	-.0223	-.0458	-.0972	-.0624
	s.d.	.0149	.0085	.0231	.0221	.0298
Light Infantry Squad	Mean	1.0374	-.0189	-.0492	-.0693	-.1025
	s.d.	.0129	.0059	.0126	.0300	.0369
Mechanized Infantry Squad	Mean	.9393	-.0371	-.0548	-.0441	-.0527
	s.d.	.0387	.0456	.0195	.0211	.0203

Overall, the largest effects of ITI are in equations for the tasks performed by Mechanized Infantry Platoons and Squads. Other factors being equal, the equations predict that collective task performance change for tasks performed by these unit types will be about four percent per month. The largest amount of variability among the ITI effects in the equations is also found for these unit types.

Somewhat smaller effects of ITI are found in equations for tasks performed by Armor Platoons. About three percent per month performance change is predicted by the equations for these tasks. The variability in ITI effects is somewhat less than that for Mechanized Infantry unit types.

The smallest ITI effects are found in equations for tasks performed by Light Infantry Platoons and Squads. For tasks performed by these unit types, the equations predict about two percent per month performance change. ITI effects in these equations are also the least variable.

The ITI effects predicted by the equations are smaller than those that are typically found for *individual* tasks. Over all tasks, the predicted performance decrement is three percent per month. This corresponds to the rate of performance decrement for individual tasks that are not very easily forgotten (Rose, Radtke, Shettel, and Hagman, 1985; p. 40).

Turnover Effects in the Equations

We cannot directly compare the **B** weight coefficients for turnover effects as we did for ITI effects. This is because there are different amounts of turnover associated with the **B** weights in Table 14. To enable the same kinds of comparisons, we computed the amount of performance change for each *one percent* change in each personnel category, for each unit type. This was done by dividing the **B** weights from Table 14 by the turnover percentage for the appropriate personnel category, averaged over scenarios. The results are shown in Table 15.

Table 15

Raw Performance Effects of Turnover in Three Personnel Categories

Unit Type	Effect on Performance of One Percent Turnover Among:		
	Senior Leaders	Junior Leaders	Non-Leader Members
Armor Platoon	-.004867	N/A	-.001967
Mechanized Infantry Platoon	-.016927	-.003025	-.001713
Light Infantry Platoon	-.001991	-.004050	-.001642
Light Infantry Squad	-.003514	-.003647	-.002278
Mechanized Infantry Squad	-.003914	-.000774	-.001351

Since it is inconvenient to examine small decimal fractions like those in Table 15, we normalized the values in Table 15 by dividing each value in Table 15 by the smallest value in the table. This gives a direct indication of the relative magnitude of performance effects. The result is presented in Table 16. The next-to-last row and column in Table 16 contain averages of the values in the main body of the table. In the final row and column of Table 16, normalized values for the

averages for unit types and personnel categories, respectively, are given. These are based on the values in the next-to-last row and column, divided by the smallest value in that row or column.

Table 16

Relative Effects on Performance of Turnover in Three Personnel Categories

Unit Type	Relative Effect on Performance of a One Percent Turnover Among:			Unit Type Means	Normalized
	Senior Leaders	Junior Leaders	Non-Leader Members		
Armor Platoon	6.3	N/A	2.5	4.4	1.7
Mechanized Infantry Platoon	22.0	3.9	2.2	9.4	3.6
Light Infantry Platoon	2.6	5.2	2.1	3.3	1.3
Light Infantry Squad	4.6	4.7	2.9	4.1	1.6
Mechanized Infantry Squad	5.1	1.0	1.8	2.6	1.0
Personnel Category Means	8.1	3.7	2.3		
Normalized	3.5	1.6	1.0		

Turnover Effects for Armor Platoon Tasks. Across the 64 equations developed for Armor Platoon collective tasks, turnover among senior leaders has the largest effect on collective skills loss and task performance. This effect is more than twice as large as that for non-leader member turnover.

Turnover Effects for Mechanized Infantry Platoon Tasks. Over the 58 equations for Mechanized Infantry Platoon collective tasks, senior leader turnover has by far the largest effect on performance. The influence of senior leader turnover on performance is almost six times that of junior leader turnover, and ten times that of non-leader turnover. In fact, the effect of senior leader

turnover for Mechanized Infantry Platoon task performance is more than three times as large as any other turnover effect in Table 16.

Turnover Effects for Light Infantry Platoon Tasks. Across the 45 equations for Light Infantry Platoon collective tasks, junior leader turnover has the largest effect on performance. The effect is about twice as large as that of either senior leader turnover or non-leader turnover.

Turnover Effects for Light Infantry Squad Tasks. Across the equations for 38 Light Infantry Squad collective tasks, junior leader and senior leader turnover have approximately the same amount of effect on collective skills loss and task performance. The effect of non-leader turnover on performance is about two-thirds that of senior or junior leader turnover.

Turnover Effects for Mechanized Infantry Squad Tasks. In the equations for the 30 Mechanized Infantry Squad collective tasks, senior leader turnover has by far the largest effect on task performance. It has more than five times the amount of influence on performance than junior leader turnover, and about three times that of non-leader turnover.

Turnover Effects Across Unit Types. Examining the last column of Table 16, it is clear that collective tasks performed by Mechanized Infantry Platoons experience the largest amount of effect on performance due to turnover of those performed by the five unit types. Much of the large difference between the effect for Mechanized Infantry Platoon tasks and tasks performed by other unit types is due to the disproportionately large amount of influence of senior leader turnover. The effects on performance of turnover in junior leaders and non-leaders are more similar in size to those found with tasks performed by the other unit types. There is no apparent reason for the very large differences in the size of the effect due to senior leader turnover between Mechanized Infantry Platoon tasks and tasks performed by other unit types.

Among the other four unit types, the effects on performance due to senior leader turnover are similar, except for tasks performed by Light Infantry Platoons. Senior leader has only about half the effect on performance for this unit type as for other unit types. Again, there is no apparent reason this should be the case.

Considering the effects of junior leader turnover on task performance, the effects across unit types are roughly similar in size, except for that found in tasks performed by Mechanized Infantry Squads. The effect of junior leader turnover for this unit type is about four times smaller than that found for other unit types.

The effects of non-leader turnover on performance are roughly similar across unit types. In absolute terms, the largest effects are found for tasks performed by Light Infantry Squads and Armor Platoons. The smallest effects are for tasks performed by Mechanized Infantry Squads. However, the overall differences in the effect of non-leader turnover across unit types are much smaller than the differences across personnel categories.

Turnover Effects Across Personnel Categories. Considering the last row of Table 16, it appears that senior leader turnover is the dominant element in affecting performance. It has more than twice as much effect on performance overall as junior leader turnover, and more than three times the effect of non-leader turnover. Senior leader turnover has more influence on performance than turnover in the other two categories combined. Some of this difference is due to the very large value for senior leader turnover for Mechanized Infantry Platoons.

Discounting the data for Mechanized Infantry Platoon tasks, senior leader turnover accounts for about 45 percent of the effects of turnover on performance. Junior leader turnover accounts for about 35 percent of effects on performance, and non-leader turnover accounts for roughly 20 percent. This has implications for Army personnel management practices. To minimize the effects of turnover on performance, efforts should be made to maximize stability in leadership positions.

Examining the differential influences of senior and junior leader turnover on performance across unit types, two patterns emerge. The first pattern is one where the effects of senior leader turnover on performance dominate those of junior leader turnover. For both Mechanized Infantry unit types, senior leader turnover has about four times as much influence on performance as does junior leader turnover. The second pattern is one in which junior leader turnover is a more dominant factor. For Light Infantry unit types, junior leader turnover has the most influence on performance of turnover in any personnel category. However, for Light Infantry Squads' tasks, senior leader turnover has about as much influence on performance as junior leader turnover. For Light Infantry Platoons' tasks, senior leader turnover has only about half the influence on performance of junior leader turnover.

Setting aside the differences in the relative influence of senior and junior leader turnover between the Light Infantry unit types, the existence of these patterns may imply something further for Army personnel management practices. There may be other unit types where turnover in senior leadership has a disproportionately large effect on collective task performance compared to the effects of junior leader turnover. More focused efforts should be made to stabilize the *senior* leadership in such unit types.

Relative Magnitude of ITI and Turnover Effects

To examine the relative magnitude of ITI and turnover effects on collective task performance, we computed the probability of receiving a "T" on task performance using the average effect (B weight) information across collective tasks in Table 14, and a common scenario. The scenario we used was a 4-month ITI, and 40 percent turnover in each personnel category. These are reasonably typical values for ITI and turnover (10 percent per month) in actual units. The results of the computations are shown in Table 17. Note that these results *do not* correspond to particular collective tasks performed by the unit types. They are based on average effects in the regression equations.

From Table 17, it is clear that ITI and turnover have approximately equal effects on performance under this scenario, for four of the five unit types. The relative effect of turnover as compared to the effect of ITI in this scenario is considerably lower for Mechanized Infantry Squads than for other unit types. As noted earlier, there is less effect of turnover on performance for this unit type than for others.

Based on this example, we can generalize that the effect of 10 percent turnover on performance is roughly equivalent to that of one month without training. If this proves to be the case for other unit types, then the estimation methodology that we developed for this research can be simplified. Estimates of the effects of ITI or of turnover can be developed in a more straightforward manner, using many fewer scenarios per unit type than we used. This would make the application of such methods more cost-effective. This, in turn, would increase the probability that these methods would be used to develop enhanced guidance for training planners.

Table 17**Effects Due to ITI and Turnover Under a Common Scenario**

Unit Type	Regression Equation Constant	Effect Due to 4-Month ITI	Effect Due to 40 Percent Turnover in Each Category	Likelihood of Receiving a "T" Rating of Performance
Armor Platoon	.9767	-.1168	-.1320	.7279
Mechanized Infantry Platoon	.9582	-.1628	-.1883	.6071
Light Infantry Platoon	1.0401	-.0829	-.0904	.8668
Light Infantry Squad	1.0374	-.0756	-.0972	.8646
Mechanized Infantry Squad	.9393	-.1484	-.0668	.7241

Relationships Between ITI and Turnover Effects in the Equations

We computed correlations between the **B** weights for ITI and the three turnover terms in the equations to identify relationships among the effects of ITI and turnover. The correlations were done for the equation terms for each unit type separately. Table 18 summarizes the correlations that achieved statistical significance.

Significant correlations between equation terms were found in equations for four of the five unit types. Only in the equations for Mechanized Infantry Squad tasks are the equation terms independent. Examining Table 18, there are two qualitatively different kinds of relationships between terms: those between the ITI term and turnover terms and those between pairs of turnover terms.

Eight of the 11 significant correlations are between ITI and turnover terms. And the size of the correlations between ITI and turnover terms is generally larger than that between pairs of turnover terms. This suggests that larger amounts of turnover increase, or potentiate, the effects of ITI on collective skills loss and task performance. This finding has implications for Army personnel management practices: when collective training is likely to be infrequent for a unit type, turnover in that unit type should be minimized as much as possible. This may result in better overall retention of collective skills in units of that type. The reverse is also true: when it is known that turnover will be high, it implies that more frequent opportunities for collective training should be provided.

The relationships between junior and senior leader turnover terms in equations performed by the two Infantry Platoon types imply that it may be important to stabilize some leadership in units in

Table 18

Statistically Significant Correlations Between Regression Equation Terms for ITI and Turnover

Unit Type	Correlation Between*		<i>r</i>	d.f.	<i>p</i>
Armor Platoon	ITI	NL	.4524	62	< .001
	ITI	SL	.6715	62	< .001
Mechanized Infantry Platoon	JL	NL	.2838	56	.05
	JL	SL	.5439	56	< .001
	ITI	JL	.4817	56	< .001
	ITI	SL	.4247	56	< .001
Light Infantry Platoon	JL	SL	.3176	39	< .03
	ITI	NL	.4656	30	< .01
	ITI	SL	.4395	39	< .01
Light Infantry Squad	ITI	NL	.8398	31	< .001
	ITI	SL	.3141	31	< .05

* ITI = Inter-training Interval; SL = Senior Leader Turnover; JL = Junior Leader Turnover; NL = Non-Leader Turnover

order to maintain collective skills. Larger values of turnover in one leader category seem to increase the effect on performance of turnover in the other category. As with these data, this may be more a factor in one unit type than in another.

Validation of Categorization Schemes

This subsection presents the results of the analyses to validate the categorization schemes classifying unit types and collective tasks on the relative amount of collective skills loss through the effects of ITI and turnover. First, analyses on the isolated unit type factors and the UTEP, using the SME retention data, are discussed. Next, validation of the isolated collective task factors and the CTEP against SME retention data are presented. Then, we discuss validation of the collective task factors and the CTEP against actual unit performance data, for Light Infantry Platoon tasks. Finally, we present the results of analyses that explore use of the categorization schemes to simplify user guidance.

Unit Type Factors and UTEP Validation

We computed correlations between the B weights for the average values of the ITI and turnover terms in the regression equations, and the seven unit-type factors and the UTEP, across the five unit types. Ten of the 28 correlations achieved or closely approached statistical significance at the 95 percent level of confidence. These are summarized in Table 19. Note that all the correlations in Table 19 are negative. This means that increases in the isolated unit-type factors, or the UTEP, are related to larger average decrements in collective task performance in the equations predicting collective skills loss for a unit type. This is in accordance with our hypotheses about the unit-type factors and the UTEP: larger factor values indicate more collective skills loss for a unit type.

Table 19

**Significant Correlations Between Unit-Type Categorization Variables
and Average B Weights in Regression Equations for Unit Types**

Correlations Between:		<i>r</i>	<i>n</i>	<i>p</i>
UTEP	Senior Leader Turnover	-.8218	5	.044
Number of Members	Junior Leader Turnover	-.9094	4	.045
Position Redundancy	Junior Leader Turnover	-.9204	4	.040
Number of Sub-teams	Junior Leader Turnover	-.9208	4	.040
Number of Collective Tasks	Junior Leader Turnover	-.9786	4	.011
Number of Leaders	Junior Leader Turnover	-.8973	4	.051
Number of Equipment Items per Member	Senior Leader Turnover	-.7686	5	.064
Number of Individual Tasks	Senior Leader Turnover	-.8277	5	.042
Number of Equipment Items per Member	ITI	-.8564	5	.032
Number of Individual Tasks	ITI	-.8557	5	.032

Each of the isolated unit-type factors is correlated with at least one of the equation terms. Two of the isolated factors—Number of Equipment Items and Number of Individual Tasks—correlate with both the senior leader turnover and ITI equation terms. The remaining five isolated factors all correlate with just the junior leader turnover term. The UTEP, a combination of the summary scoring on the isolated factors, correlated only with the senior leader turnover term in the equations. Interestingly, none of the unit-type factors or the UTEP correlated with non-leader turnover. This agrees with the result above, however, where non-leader turnover was shown to have a relatively minor amount of influence (20 percent of the overall effect due to turnover) in the regression equations. This supports our hypothesis that stability in leader positions is particularly important for collective skills retention and collective task performance.

These results show substantial support for the isolated unit-type factors as predictors of collective skills loss, but less support for the UTEP as a predictor. However, this analysis is based on only five cases. Before making generalizations about the relationships between collective skills loss and the UTEP, similar analyses involving larger numbers of unit types are needed.

Isolated Collective-Task Factors Validation Against SME Estimate Data

We computed correlations between the isolated collective-task factors and the regression equation terms, for tasks performed by each unit type separately. Table 20 shows the correlations that achieved statistical significance at the 95 percent level of confidence.

In equations for Armor Platoon tasks, larger ratings on the Established/Emergent factor were associated with larger effects due to senior leader turnover and ITI. Collective tasks with larger numbers of supporting individual tasks were associated with larger effects due to non-leader turnover and ITI. And, tasks rated as more interactive than coactive were associated with larger effects due to non-leader turnover, senior leader turnover, and ITI.

In Mechanized Infantry Platoon tasks' equations, only the Number of Individual Tasks factor was related to the magnitude of collective skill loss effects. Collective tasks with larger numbers of supporting individual tasks had larger effects due to junior leader turnover, senior leader turnover, and ITI than those with fewer individual tasks.

For Light Infantry Platoon tasks' equations, only the Number of Individual Tasks was related to specific effects in the equations. Collective tasks with larger numbers of supporting individual tasks were associated with larger effects due to non-leader turnover and ITI than those with fewer individual tasks.

In equations for Light Infantry Squad tasks, we found some apparent contradictions with the predicted relationships between the isolated factors and the effects of turnover and ITI. The Number of Sub-teams per Subtask factor correlated with three of the regression equations' terms: non-leader turnover, junior leader turnover, and ITI. However, the correlations with non-leader turnover and ITI are positive, indicating a reverse relationship from that expected between of Number of Sub-teams per Subtask and these terms. Likewise, tasks' Coactive/Interactive ratings correlated with junior leader turnover and ITI, but the correlations were positive. Finally, rated Potential for Correction or Compensation correlated with non-leader turnover—also positively. Number of Individual Tasks correlated with non-leader turnover and ITI, in the expected direction.

No significant correlations were found between the isolated factors and regression equation terms for tasks performed by Mechanized Infantry Squads.

For the most part, these results are consistent, and support the validity of a subset of the collective task factors as predicting the relative magnitude of ITI and turnover effects in the regression equations. However, none of the correlations involving the Number of Subtasks and Standards factor achieved statistical significance. And, the one significant correlation involving rated Potential for Compensation or Correction was in the opposite direction from that we expected. Somewhat mixed results were also found for tasks Coactive/Interactive ratings, since both statistically significant correlations involving this factor for Light Infantry Squad Tasks were positive, rather than negative. Finally, Light Infantry Squad task ratings of Number of Sub-teams per Subtask had mixed

Table 20

**Significant Correlations Between Isolated Collective-Task Factors
and Regression Equation Components**

Unit Type	Correlation Between:		r	N	p
Armor Platoon	Established/Emergent Rating	Senior Leader Turnover	-.4754	64	<.001
	Established/Emergent Rating	ITI	-.3520	64	<.01
	Number of Individual Tasks	Non-leader Turnover	-.2772	58	<.02
	Number of Individual Tasks	Senior Leader Turnover	-.2350	61	<.03
	Coactive/Interactive Rating	Non-leader Turnover	-.2520	61	.03
	Coactive/Interactive Rating	Senior Leader Turnover	-.3097	64	<.01
	Coactive/Interactive Rating	ITI	-.3016	64	<.01
Mechanized Infantry Platoon	Number of Individual Tasks	Junior Leader Turnover	-.3509	58	<.01
	Number of Individual Tasks	Senior Leader Turnover	-.2201	58	<.05
	Number of Individual Tasks	ITI	-.3325	58	<.01
Light Infantry Platoon	Number of Individual Tasks	Non-leader Turnover	-.3218	44	<.03
	Number of Individual Tasks	ITI	-.3497	44	<.01
Light Infantry Squad	Number of Sub-teams per Subtask	Non-leader Turnover	.6426	33	<.001
	Number of Sub-teams per Subtask	Junior Leader Turnover	-.3065	36	<.04
	Number of Sub-teams per Subtask	ITI	.5186	38	<.001
	Number of Individual Tasks	Non-leader Turnover	-.4213	33	<.01
	Number of Individual Tasks	ITI	-.4052	38	<.001
	Coactive/Interactive Rating	Junior Leader Turnover	.3000	36	<.04
	Coactive/Interactive Rating	ITI	.2774	38	<.05
	Potential for Compensation or Correction	Non-leader Turnover	.3266	33	<.04

relationships with equation terms. From these findings, we claim qualified support for the isolated collective-task factors for predicting the relative size of effects due to turnover and ITI. The strongest support is found for tasks Established/Emergent ratings, the Number of Individual Tasks supporting collective task performance, and tasks' Coactive/Interactive ratings.

It is interesting to note that the only findings that contradicted our expectations were for Light Infantry Squad tasks' equations, and that no significant correlations were found for Mechanized Infantry Squad tasks' equations. It would appear from these results that the categorization scheme for collective tasks may be more appropriate for Platoon tasks than for Squad tasks. Some of the reason

for this apparent result may be statistical artifact. Both Squad unit types' equations have somewhat less variability in *B* weights for equation terms than do equations for Platoon unit types' tasks. Also, the variability of the isolated collective-task factors for Squads' tasks is somewhat lower than that for the Platoons unit types' tasks. Finally, there are fewer collective tasks for either Squad unit type than for any of the Platoon unit types. The combination of lower variability on the individual variables and a smaller number of cases makes it more difficult for analyses to achieve statistical significance, even if correlations are of the same magnitude. We speculate that this may be the case here.

CTEP Validation Against SME Estimate Data

We have separated the discussion of validating the CTEP from that for the isolated factors, because we were able to conduct some interesting follow-up analyses to the basic CTEP correlations that are not meaningful with the isolated factors. We first performed correlation analyses between the CTEP and the regression equation terms, as was done for the isolated factors. The correlations that achieved statistical significance at the 95 percent level of confidence are summarized in Table 21.

Table 21

Significant Correlations Between CTEP and Regression Equation Terms

Unit Type	Correlation Between:		<i>r</i>	N	<i>p</i>
Armor Platoon	CTEP	Non-leader Turnover	-.2205	64	< .05
	CTEP	Senior Leader Turnover	-.3080	64	< .01
	CTEP	ITI	-.2564	64	< .02
Mechanized Infantry Platoon	CTEP	Junior Leader Turnover	-.3150	57	< .01
	CTEP	ITI	-.2904	58	< .02
Light Infantry Platoon	CTEP	Non-leader Turnover	-.4294	38	< .01
	CTEP	Senior Leader Turnover	-.5314	34	< .001
	CTEP	ITI	-.6524	38	< .001

No statistically significant correlations were found between the CTEP and any regression equation terms for tasks performed by either Squad unit type. However, significant negative correlations were found between the CTEP and regression equation terms for each of the three Platoon unit types. For Armor Platoon tasks' equations, non-leader turnover, senior leader turnover,

and ITI terms were all found to be negatively correlated with the CTEP. This means that a larger value of CTEP is associated with larger amounts of collective skills loss due to each of the three terms.

For Mechanized Infantry Platoon tasks' equations, junior leader turnover and ITI terms had negative correlations with the CTEP. For Light Infantry Platoon tasks' equations, non-leader turnover, senior leader turnover, and ITI terms had significant negative correlations with the CTEP.

This provides fairly substantial support for the validity of the CTEP as a predictor of the relative effects on collective skills loss due to turnover and ITI. However, the support is limited to tasks performed by Platoon unit types. We decided to examine more closely the relationships between SME estimates of performance and the CTEP ratings of collective tasks.

We first computed the mean number of points assigned to the "T" category for all SME estimates of performance, for tasks associated with each CTEP category, for each unit type. This was done using raw data for each performance estimation scenario; the scenarios were not segregated by the collective task to which they pertain. We plotted the resulting values to examine how SME performance estimates correspond to assigned CTEP numeric categories. The results are shown in Figures 9 through 13. The numbers that appear in the body of each Figure are the number of collective tasks associated with each numeric CTEP category.

Examining the plots in Figures 9 to 13, it is apparent that there are at least small performance differences between at least the extreme values of the distribution of CTEP, for Platoon unit types' collective tasks. For Squad unit types, there is at least a trend for higher numeric values of the CTEP to be associated with lower levels of performance (discounting in both cases the higher performance rating associated with the single task assigned a CTEP numeric value of 10). To determine if these apparent differences are statistically reliable, we performed follow-up one-way analyses of variance (ANOVAs) on the performance data. One ANOVA was performed per unit type. The CTEP numeric values were used to designate groups for these analyses. We also performed follow-up (to the ANOVAs) multiple-range tests, as appropriate, using Tukey's HSD procedure (Kirk, 1964) to determine which groups (defined by CTEP numeric score) differed from which other groups. The experiment-wise error rate for each ANOVA and multiple range test was set at $\alpha = .05$.

For four of the five unit types, the results of the ANOVAs allowed us to conclude that performance differences exist among the means of groups as defined by the CTEP numeric categories. Overall statistical results were:

1. For Armor Platoon tasks, $F = 24.31$, d.f. = 6, 1795, $p < .001$
2. For Mechanized Infantry Platoon tasks, $F = 28.53$, d.f. = 6, 3008, $p < .001$
3. For Light Infantry Platoon tasks, $F = 37.06$, d.f. = 6, 2332, $p < .001$
4. For Light Infantry Squad tasks, $F = 5.62$, d.f. = 4, 1059, $p < .001$
5. For Mechanized Infantry Squad tasks, $F = 0.54$, not significant.

From the follow-up multiple range tests, we concluded the following:

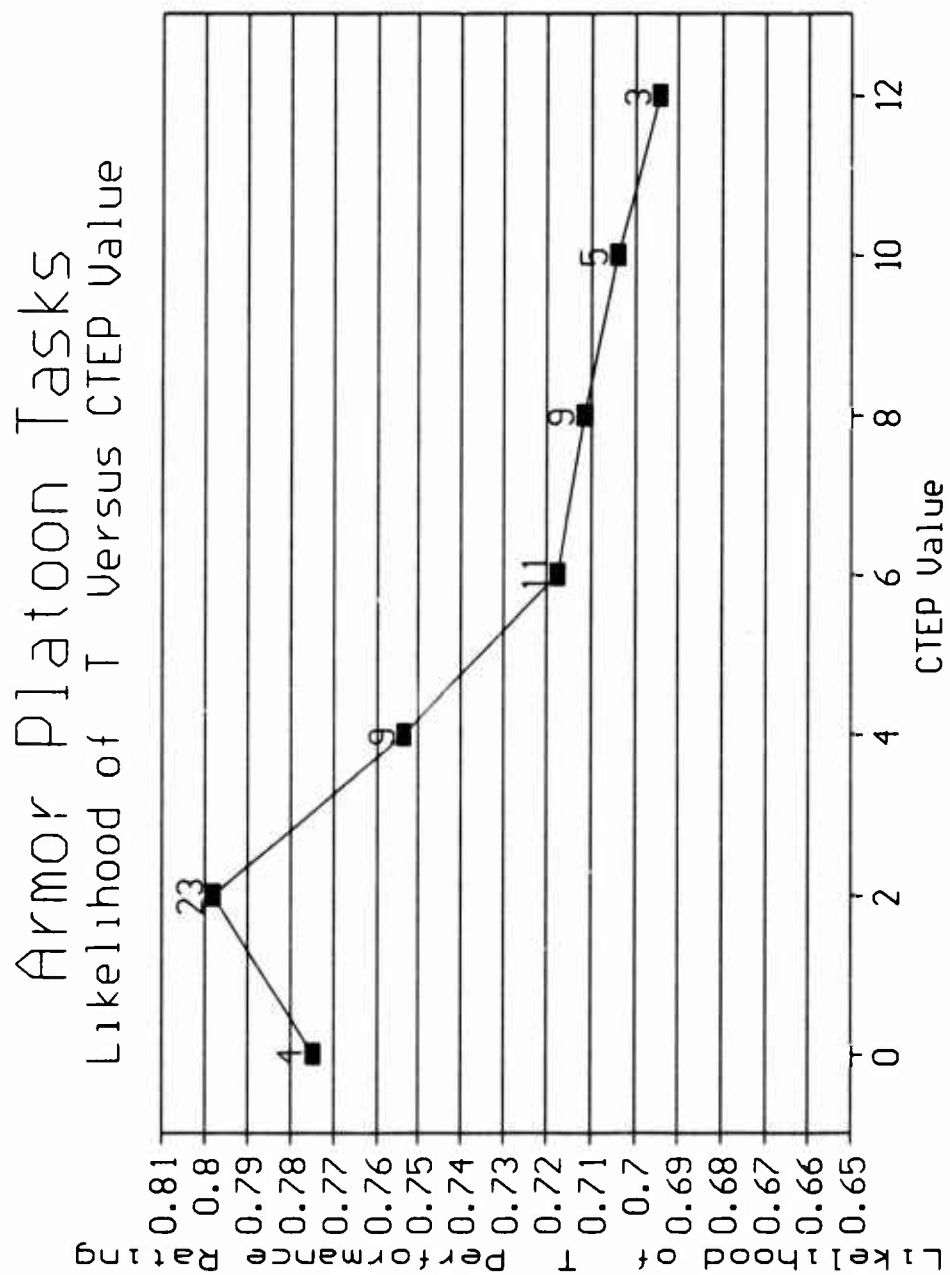


Figure 9. Mean Percentage of Points Assigned to "T" Performance Category by CTEP Numeric Score—Armor Platoon Tasks.

Mechanized Infantry Platoon Tasks Likelihood of "T" Versus CTEP Value

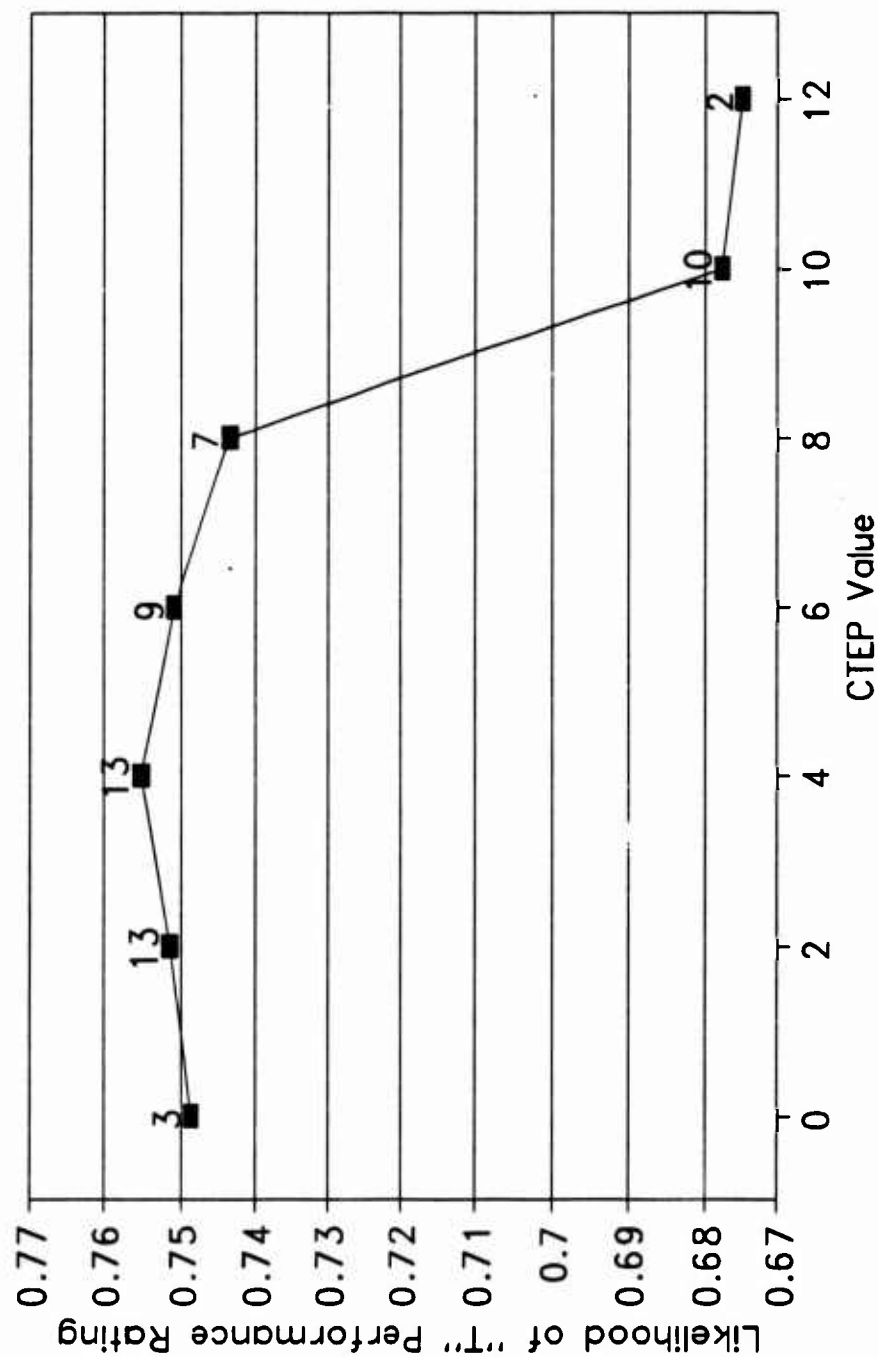


Figure 10. Mean Number of Points Assigned to "T" Performance Category by CTEP Numeric Category—Mechanized Infantry Platoon Tasks.

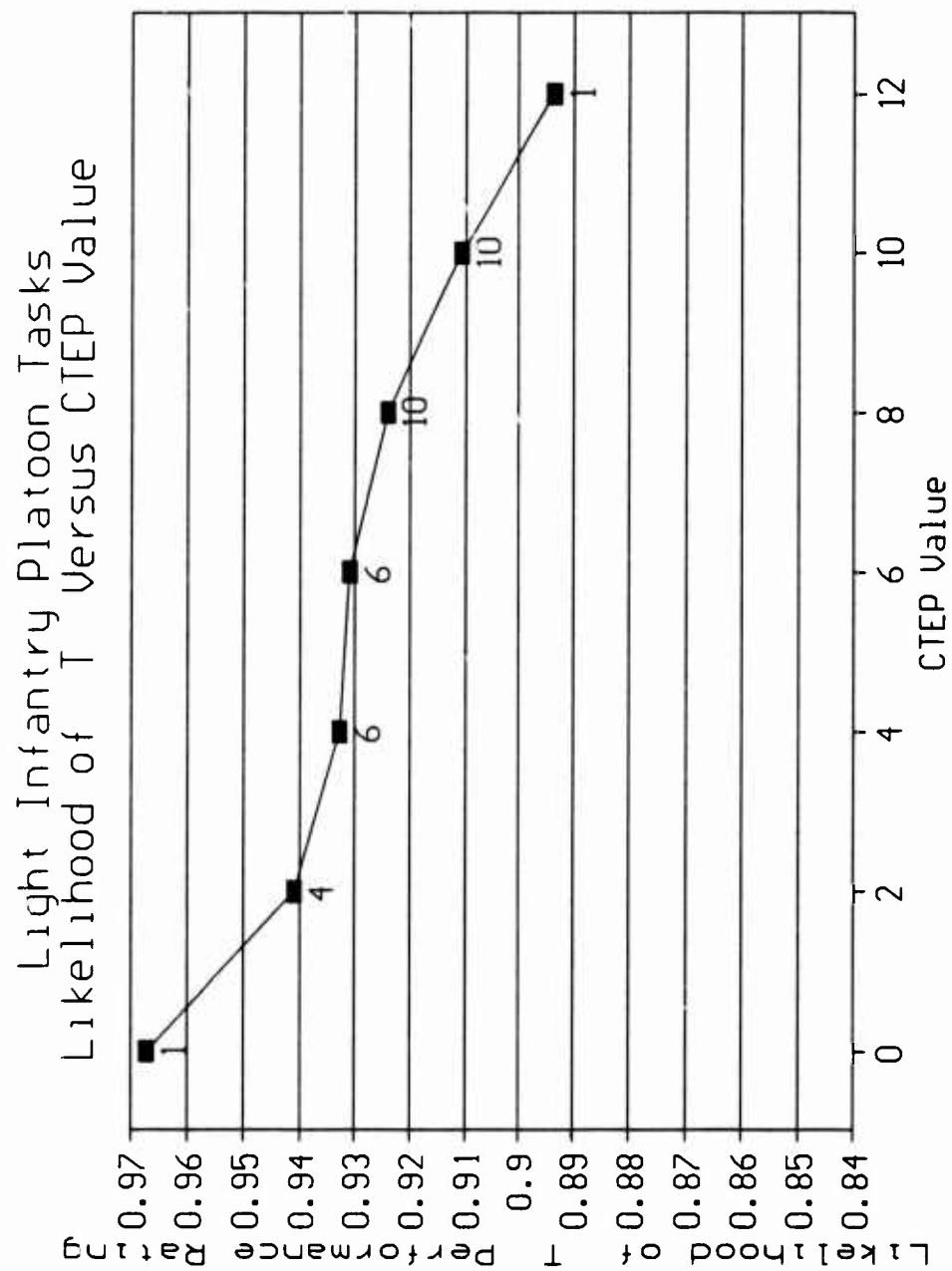


Figure 11. Mean Number of Points Assigned to "T" Performance Category by CTEP Numeric Score—Light Infantry Platoon Tasks.

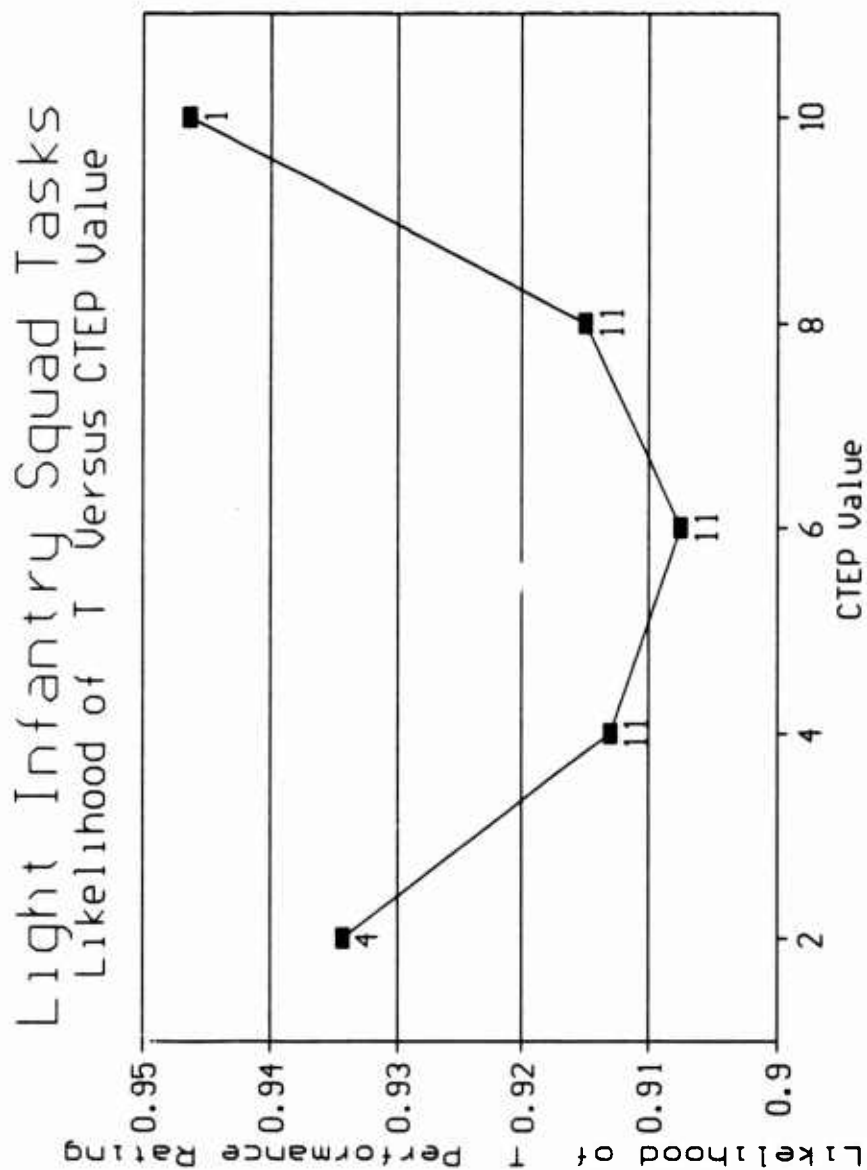


Figure 12. Mean Percentage of Points Assigned to "T" performance Category by CTEP Numeric Category—Light Infantry Squad Tasks.

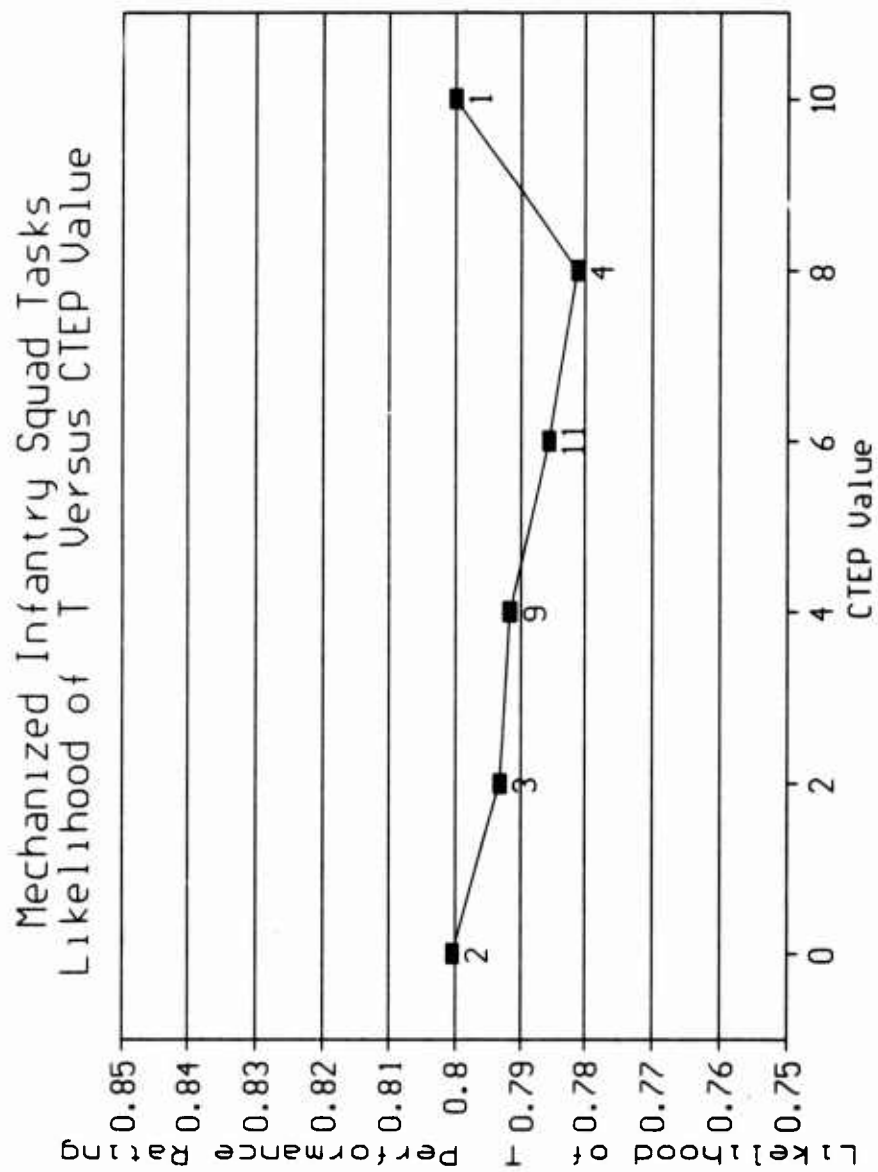


Figure 13. Mean Number of Points Assigned to "T" Performance Category by CTEP Numeric Score—Mechanized Infantry Squad Tasks.

1. For Armor Platoon tasks, tasks with CTEP numeric scores of 0, 2, and 4 are reliably different from tasks CTEP scores of 6 or greater. The overall performance estimate mean across the category with CTEP scores of 0, 2, and 4 is significantly higher than the performance estimate mean across the other category. No differences exist between CTEP numeric score groups within the two categories.
2. For Mechanized Infantry Platoon tasks, tasks with CTEP scores of 10 and 12 are reliably different from tasks with CTEP scores of 8 or less. The overall performance estimate mean across the category with CTEP scores of 8 or less is higher than the performance estimate mean across the category with CTEP scores of 10 or 12. No differences exist between CTEP numeric score groups within the two categories.
3. For Light Infantry Platoon tasks, there are three statistically distinct categories based on CTEP numeric scores. The first category includes tasks with CTEP numeric scores of 10 and 12, which has the lowest performance estimate mean of the three categories. The second category includes tasks with CTEP numeric estimate scores of 4, 6, and 8. This category has performance estimate means higher than those of the first category. The final category includes tasks with CTEP numeric scores of 0 and 2. Tasks in this category have the highest performance estimate means.
4. For Light Infantry Squad tasks, there are two statistically distinct categories based on CTEP numeric scores. The first category includes tasks with CTEP numeric scores of 2 and 10, which have the higher mean performance estimate score. The other category includes tasks with CTEP numeric scores of 4, 6, and 8. This category has a lower performance estimate mean. This result is apparently different from the pattern established in data for the Platoon unit types. Note from Figure 12, however that there is only one Light Infantry Squad task with a CTEP numeric score of 10. If other tasks had been assigned CTEP numeric scores of 10, it is possible that performance estimates on those tasks would have been lower. If this were the case, the pattern of monotonically decreasing performance with higher CTEP numeric scores could have been maintained in the data for Light Infantry Squad tasks.
5. While multiple range tests were not appropriate for the data for Mechanized Infantry Squad tasks, it should be noted (Figure 13) that the trend for tasks for this unit type is similar to that found for other unit types. As the CTEP numeric score increases, there is a decrease in the performance estimate (with the exception of the single task assigned a CTEP numeric score of 10). The small amount of variability in the performance estimates for tasks assigned different CTEP numeric scores does not allow any statistical conclusions about this apparent trend, however.

These results are consistent and encouraging. It appears that the CTEP numeric score assigned to collective tasks can at least discriminate broadly between tasks where performance is likely to be higher and those where performance is likely to be lower. In this sense, the CTEP can be thought of as a task difficulty measure, as discussed earlier.

Validation of Collective-Task Factors and CTEP Against Unit Performance Data

As discussed in the Procedures section, we developed two different performance measures for Light Infantry Platoon task performance at the JRTC, and performed median tests to determine if there are relationships between these measures and the isolated collective-task factors and the CTEP. This subsection presents the results of those analyses.

Analyses for Isolated Collective-Task Factors. Table 22 (two pages) presents the results of the analyses for the isolated collective-task factors. Median tests on the unweighted performance variable for each factor are shown in the left half of the Table; tests on the weighted performance variable are shown in the right half. To interpret this Table, look at each sub-table—for a factor and a performance variable (weighted or unweighted)—separately. Each sub-table shows the number and proportion of cases above and below the overall median, for "Low" and "High" values of a factor. When the proportion of cases above the median *decreases* from the "Low" to the "High" column, this indicates support for our hypotheses about the factor. Performance should be lower if tasks score "High" on a factor. The X^2 statistic for each median test, and the achieved level of statistical significance for the X^2 test, are presented at the bottom of each sub-table.

Number of Subtasks and Standards. For the Number of Subtasks and Standards factor, the median test for the weighted performance variable approached statistical significance, but the test for the unweighted performance variable did not. For the weighted performance variable, there was a tendency for poorer performance to be associated with a "High" declaration for a task on the factor. This result agrees with the result above of validating this factor against SME estimate data. It is not a particularly good predictor of collective task performance.

Established/Emergent Rating. For the Established/Emergent factor, neither the test of the unweighted nor the weighted performance variable approached statistical significance. For both performance variables, there was some tendency for tasks declared "High" on the Established/Emergent factor to show lower levels of performance, but the amount of change in the proportion of tasks above and below the median from the "Low" to the "High" category was not large.

Number of Sub-teams per Subtask. For the Number of Sub-teams per Subtask factor, the results of median tests for both unweighted and weighted performance variables were exactly the opposite of our hypotheses. As the factor effect declaration for collective tasks went from "Low" to "High," the proportion of cases above the median *increased*. This agrees to some extent with the contradictory results found when validating this factor against SME estimate data. However, those results were for tasks performed by Light Infantry Squads, rather than Platoons.

Number of Individual Tasks. For this factor, the results of the median tests for both performance variables were statistically significant. And, the proportion of cases above the median decreased from the "Low" to the "High" factor effect declaration, in both tests. This is in accordance with our hypotheses, and agrees with the results from validating this factor against SME performance estimates.

Coactive/Interactive Rating. The findings for this factor are similar to those for the Number of Individual Tasks factor. For both performance variables, the proportion of cases above

Table 22

Results of Median Tests for Isolated Collective-Task Factors

Unweighted Performance Measure (N=1230)			Weighted Performance Measure (N=859)		
Factor: Number of Subtasks and Standards					
	"Low"	"High"		"Low"	"High"
Number/ Proportion > Median	108	412	Number/ Proportion > Median	103	323
	.42	.42		.55	.47
Number/ Proportion < Median	148	562	Number/ Proportion < Median	82	351
	.58	.58		.45	.53
$\chi^2 = 0.00$			$\chi^2 = 3.19$		
$p = .96$			$p = .07$		
Factor: Established/Emergent Rating					
	"Low"	"High"		"Low"	"High"
Number/ Proportion > Median	193	327	Number/ Proportion > Median	136	290
	.45	.41		.51	.49
Number/ Proportion < Median	248	472	Number/ Proportion < Median	131	302
	.55	.59		.49	.51
$\chi^2 = 1.55$			$\chi^2 = .21$		
$p = .21$			$p = .64$		
Factor: Number of Sub-teams per Subtask					
	"Low"	"High"		"Low"	"High"
Number/ Proportion > Median	286	234	Number/ Proportion > Median	168	258
	.39	.47		.35	.67
Number/ Proportion < Median	445	265	Number/ Proportion < Median	302	131
	.61	.53		.67	.33
$\chi^2 = 7.02$			$\chi^2 = 78.34$		
$p = .01$			$p < .01$		

Table 22
(Concluded)

Results of Median Tests for Isolated Collective-Task Factors

Unweighted Performance Measure (N=1230)			Weighted Performance Measure (N=859)		
Factor: Number of Individual Tasks					
	"Low"	"High"		"Low"	"High"
Number/ Proportion > Median	241	279	Number/ Proportion > Median	178	248
	.50	.37		.58	.45
Number/ Proportion < Median	242	468	Number/ Proportion < Median	128	305
	.50	.63		.42	.55
X ² = 18.41			X ² = 13.46		
p < .01			p < .01		
Factor: Coactive/Interactive Rating					
	"Low"	"High"		"Low"	"High"
Number/ Proportion > Median	118	402	Number/ Proportion > Median	124	302
	.51	.40		.72	.44
Number/ Proportion < Median	113	579	Number/ Proportion < Median	49	384
	.49	.60		.28	.56
X ² = 8.60			X ² = 41.16		
p < .01			p < .01		
Factor: Potential for Compensation or Correction					
	"Low"	"High"		"Low"	"High"
Number/ Proportion > Median	204	316	Number/ Proportion > Median	240	186
	.42	.43		.62	.40
Number/ Proportion < Median	283	427	Number/ Proportion < Median	150	283
	.58	.57		.38	.60
X ² = 0.02			X ² = 39.91		
p = .87			p < .01		

the median decreased from the "Low" to the "High" factor-effect declarations for tasks. Both tests were statistically significant, indicating support for the validity of this factor.

Rating of Potential for Compensation or Correction. The results of the median tests on this factor are mixed. For the unweighted performance variable, there were essentially no differences in the proportion of cases above and below the median, going from the "Low" to the "High" factor-effect declaration. For the weighted performance variable, however, the proportion of cases above the median decreased significantly from the "Low" to the "High" factor-effect declaration.

Summary of Isolated-Factor Validation. To summarize, relatively good support was found in these analyses for three of the six factors, modest support was found for two more—Number of Subtasks and Standards, and Established/Emergent Rating, but results completely contradicted our hypotheses about the effects of Number of Sub-teams per Subtask on performance. These results generally agree with the results of validating the isolated collective-task factors with the SME estimate data.

Analyses for the CTEP. Table 23 presents the results of the median test analyses of the CTEP against the two performance variables. This Table is interpreted in a way similar to that for the isolated factor results, except that there are more categories in each sub-table. As the CTEP numeric score increases, the proportion of cases falling below the median should increase, as well, if our hypotheses are valid.

For both performance variables, the median tests yielded statistically significant results. There is a tendency for tasks assigned larger CTEP numeric scores to show somewhat lower levels of performance, in these data. While the results are not unequivocal, they do indicate some validity for the CTEP as a predictor of the level of performance on collective tasks. This is further illustrated by the plots of the proportion of cases falling above the median, by CTEP numeric score, in Figures 14 and 15.

As a follow-up to the median tests for the CTEP, we also computed the correlation between each of the performance variables and the assigned CTEP numeric scores for the associated collective tasks. For the unweighted performance variable, the correlation coefficient is $-.115$ (d.f. = 1228, $p < .01$). for the weighted performance variable, the correlation is $-.232$ (d.f. = 857, $p < .01$). While modest in size, these correlations reinforce the overall findings—the CTEP is a reasonably good, though not very robust, predictor of collective task performance.

Two Additional Analyses Using Unit Performance Data

To round out the possible comparisons between performance measures and as a final test of the relationships between the CTEP and performance, two additional analyses were performed.

The first was to compute the correlations between the performance estimates made by SMEs and the performance variables obtained from JRTC data. This was done for Light Infantry Platoon tasks for which both SME-estimate and JRTC data were available. The rationale for this analysis was to determine whether SME estimate-based data are at all valid when compared to actual unit performance data. To represent the SME estimate data, we applied the regression equations for the collective tasks in the JRTC data under a common scenario of ITI (three months) and turnover (33 percent) in each personnel category. Modest, but statistically significant, correlations were found

Table 23

Median Test Results for the CTEP

Unweighted Performance Variable (N = 1230)						
	CTEP Numeric Score					
	2	4	6	8	10	12
Number/ Proportion > Median	3	131	70	121	187	8
	.30	.49	.49	.36	.47	.38
Number/ Proportion < Median	7	135	74	212	269	13
	.70	.51	.51	.64	.53	.63
$\chi^2 = 13.55$ $p < .02$						

Weighted Performance Variable (N = 859)						
	CTEP Numeric Score					
	2	4	6	8	10	12
Number/ Proportion > Median	3	105	46	115	146	11
	.30	.61	.54	.47	.44	.52
Number/ Proportion < Median	7	66	39	128	183	10
	.70	.39	.46	.53	.56	.48
$\chi^2 = 15.92$ $p < .01$						

between both the unweighted and weighted JRTC-based task performance variables, and the SME estimates. For the unweighted performance variable, the correlation coefficient is .141 (d.f. = 1228, $p < .01$). For the weighted performance variable, the correlation coefficient is .359 (d.f. = 857, $p < .01$). These results indicate that SME estimates of performance have some validity when evaluated against measured performance. It is interesting to note that a larger correlation was found for the weighted JRTC performance variable. We believe that this means that SMEs considered the criticality and leader involvement of subtasks when making their performance estimates, even though they may not have done so consciously. If verified, this would reinforce the validity of SME performance estimates as a means of obtaining data on collective skills loss and associated changes in

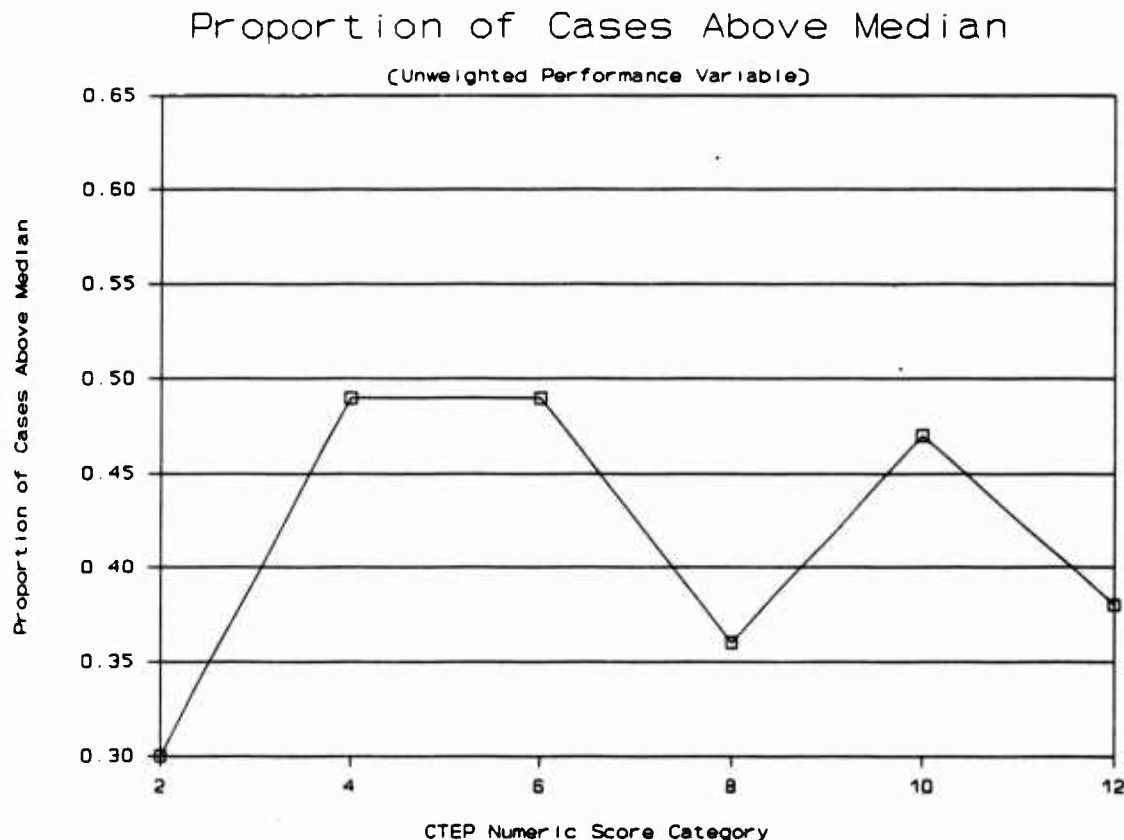


Figure 14. Proportion of Cases Above the Median by CTEP Numeric Score Category—Unweighted Performance Variable.

collective task performance.

The second analysis pertains to the data reported in Table 1 in the Introduction. These are the only available performance *change* data for collective tasks. We computed the correlation between the performance change scores in the last column of Table 1 and the available CTEP numeric scores for the collective tasks shown in that Table. The correlation coefficient was only .031, indicating practically no relationship between the performance change data and the CTEP numeric scores. As mentioned in the Introduction, there are many uncontrolled factors that may have affected the validity of the performance change scores in Table 1 as actual estimates of performance. Therefore, we do not know whether this correlation coefficient is a good estimate of the validity of the CTEP for predicting performance change.

UTEP Plus CTEP as a "Universal" Predictor of Collective Skill Loss Effects

Since there was modest but not overwhelming support for the usefulness of the UTEP and CTEP for predicting relative collective skills loss for unit types and collective tasks, we decided to

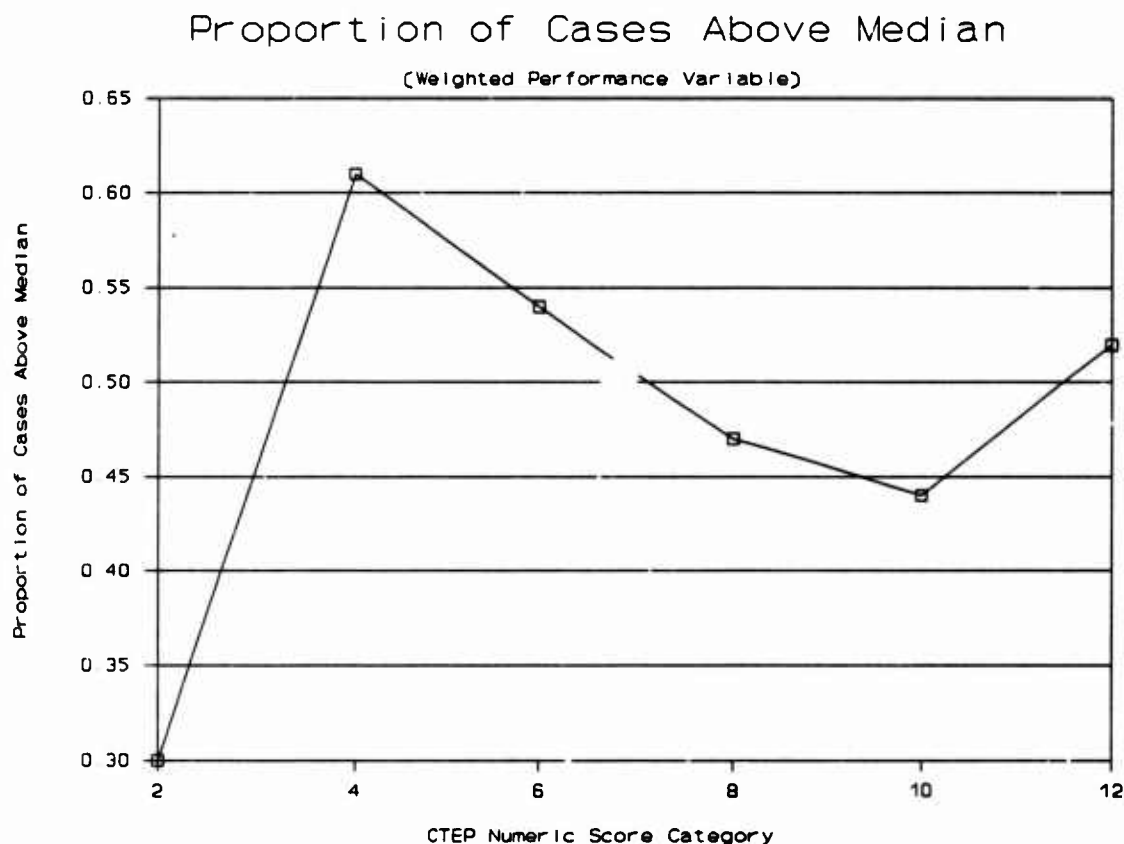


Figure 15. Proportion of Cases Above the Median by CTEP Numeric Score Category—Weighted Performance Variable.

explore whether a combination of the two would support comparing the relative amount of skill loss for collective tasks *across* unit types. To develop a numeric score that would reflect the combination of the UTEP and CTEP, we added the UTEP for a unit type to the CTEP for each collective task performed by that unit type. This gave a number with a theoretical range of 0 to 24. A zero on this scale predicts the least relative loss of collective skills due to ITI and turnover; a 24 predicts the most. As applied to the 235 collective tasks studied here, the scale values range from 4 to 24.

We then computed a performance figure for each task, using the regression equations under a common scenario (the one described above), and computed the average of the performance figures for each group of tasks as defined by the UTEP+CTEP numeric score. A plot of the results is shown in Figure 16. This plot clearly shows a trend toward lower levels of collective task performance as the UTEP+CTEP numeric score increases. We computed the correlation coefficient between the UTEP+CTEP numeric score and the performance score for each task, which is $-.375$ (d.f. = 233, $p < .01$). This confirms a modest but actual relationship between the combination of UTEP and CTEP, and collective skills loss leading to decrements in collective task performance.

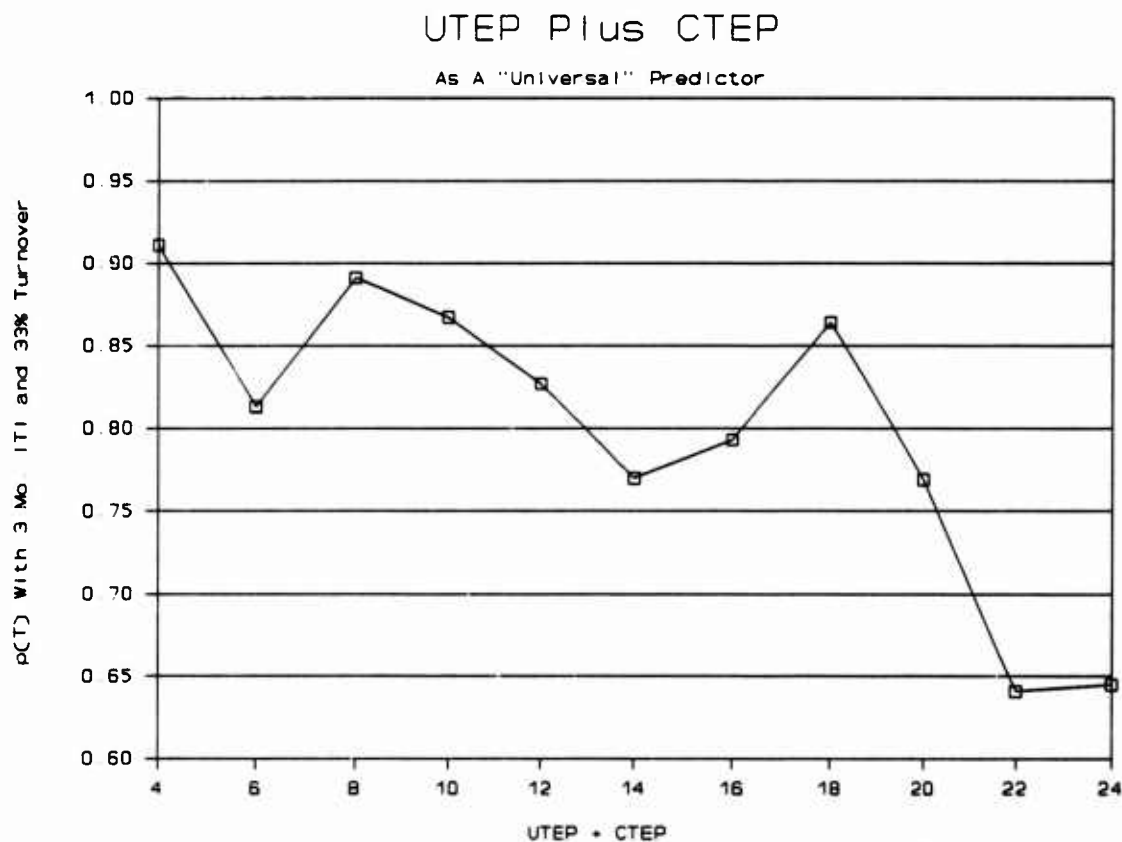


Figure 16. Plot of Average Performance for Tasks in UTEP+CTEP Numeric Score Categories.

Attempts to Simplify User Guidance

One of the purposes of the collective task categorization scheme was to determine if the same regression equation could be used for more than one task, for simplifying user guidance. This subsection describes the results of the analyses to determine if this was feasible.

Discriminant Analyses

Table 24 presents a summary of the results of the discriminant analyses described in the previous section, segregated by unit type. Three of the 35 analyses we attempted could not be performed because the data did not meet the requirements of the discriminant analysis procedure. For the remaining 32 analyses on the isolated collective-task factors and the CTEP, the proportion of

cases correctly classified³ by the derived discriminant function is shown in Table 24. Below this number are letters indicating which regression equation terms contributed to the computed discriminant function.

Table 24

**Results of Discriminant Analyses—Classification Success
and Variables in Discriminant Function Equations**

Unit Type	Proportion of Cases Correctly Classified by Discriminant Function and Variables* Entered into Discriminant Function						
	Discriminant Function Grouping Variable						
	CTEP	High/Low Number of Subtasks & Standards	High/Low Established vs Emergent Rating	High/Low Number of Sub-teams/ Subtask	High/Low Number of Individual Tasks	High/Low Coactive vs Interactive Rating	High/Low Potential Compens./ Correction
Armor Platoon	.375	.656	.703	.531	.641	.781	.641
	I, S	N	S	N	I	I	N, S
Mechanized Infantry Platoon	.310	.631	.719	N/A	.754	.701	N/A
	I, S	I, N	I, S, J	N/A	N, J	J	N/A
Light Infantry Platoon	.400	.631	.710	.684	.894	.605	.842
	I, S, J	I	J, I, N	I	I, J	I	I, N
Light Infantry Squad	.397	.553	.682	.763	.710	.789	.710
	S, N, J	J, I	N, J	I, S, J, N	I, J, N	S, N	I, N
Mechanized Infantry Squad	.400	N/A	.700	.667	.700	.700	N/A
	I	N/A	N	J	N, I	I, N	N/A

* The letters in the Table represent the following regression equation components: C—regression equation Constant term; N—Non-leader (Member) turnover term; J—Junior leader turnover term; S—Senior leader turnover term; I—ITI.

The groupings of regression equations by the discriminant functions did not agree particularly well with the groups defined by "Low" and "High" factor effect declarations for the isolated collective-task variables. The best agreement between discriminant function groupings and factor declarations, across unit types, was for the isolated factors Number of Individual Tasks, Established/Emergent Rating, Coactive/Interactive Rating, and Potential for Compensation or Correction in Task Performance. Even for these factors, agreement between discriminant function groupings and the factor effect declaration groupings averaged only about 70 percent. We concluded that the isolated collective-task factors, as initially defined and scored, do not provide a statistical basis for using the same regression equation to predict performance for more than one task.

³ Classified as "Low" or "High" effect for the isolated factors, or into the group defined by CTEP numeric score.

Agreement between the groupings of regression equations by discriminant functions and the CTEP numeric score groupings was poor. On average, only about 38 percent agreement was found between the two groupings. The CTEP, as initially defined, is not a basis for using the same regression equation to make predictions for multiple collective tasks.

Exploring Alternatives. In examining the detailed results of these analyses, we noticed that the discriminant function equations tended to assign tasks' regression equations to groups that suggested less collective skills loss than did either the isolated collective-task factors or the CTEP. This led to the hypothesis that the isolated collective-task factors might be predicting higher levels of collective skills loss than is the case in the SME-estimate data.

To test this hypothesis, we re-scored each of the isolated collective-task factors, using the 75th percentile as the "cutpoint" between "High" and "Low" factor effect declarations. (Recall that we originally used the median as a "cutpoint.") We will refer to the re-scored factors as "F-75 Factors." The number of "High" declarations for each collective task on the F-75 factors were summed to give a re-scored CTEP numeric score. We will refer to this as the "CTEP-75" score. Like the original CTEP, the CTEP-75 score can range in value from 0 to 12.

The F-75 factor scores and the CTEP-75 score were used in repeated discriminant analyses, to determine whether improved agreement would be found between isolated F-75 factors' or CTEP-75 groupings of regression equations and groupings made by the discriminant functions. These analyses showed a slight improvement in the agreement between isolated F-75 factors and CTEP-75 groupings, and discriminant equations' groupings, over the original analyses. However, the increase in the amount of agreement averaged only about three percent, across factors and unit types. We concluded that the revised scoring scheme for the F-75 factors and the CTEP-75 would not support the use of the same regression equation for predicting collective skills loss for multiple tasks.

We made one additional attempt to use the collective task factors as a basis for using the same regression equation for making predictions for more than one task. In the original discriminant analyses, four of the isolated collective-task factors (Number of Individual Tasks, Established/Emergent Rating, Coactive/Interactive Rating, and Potential for Compensation or Correction in Task Performance) showed about the same level of agreement with the groupings of regression equations by the discriminant function equations—higher levels of agreement than the remaining two factors. We decided to use only these four factors to develop a revised CTEP (referred to as "CTEP-4"), and test whether scoring using this factor-composite would agree more closely with groupings by the discriminant function equations. CTEP-4 numeric scores were developed for each task, using the original, median "cutpoint," scoring of the four isolated collective task factors. Numeric scores on CTEP-4 can range from 0 to 8. CTEP-4 was used as the grouping variable in five additional discriminant analyses, one per unit type.

Overall agreement between the CTEP-4 numeric-score categories and the groupings of regression equations by the discriminant function equations averaged about 66 percent across unit types. While this is a considerable improvement in overall agreement over that found for the original CTEP and the CTEP-75, it is not high enough to warrant using the same regression equation for predicting collective task performance for multiple tasks.

Based on the overall results of the discriminant analyses, we concluded that the neither the isolated collective-task factors nor any version of the CTEP make it possible to use one regression

equation to predict collective task performance for more than one task. We therefore rejected the idea of using the CTEP or the collective-task factors for this purpose.

Cluster Analyses

While the collective-task factors and the CTEP do not support using one equation for predictions for more than one task, it was possible that there might be inherent similarities—unrelated to the collective-task categorization scheme—between the equations for groups of tasks. If such similarities exist, it would be possible to use the same equation to make predictions for multiple tasks. We performed cluster analyses on the regression equations for the tasks performed by each unit type separately, to attempt to identify such similarities.

The results of the cluster analyses were evaluated by examining pairs of regression equations that were identified as being most similar by the analysis procedure, for tasks performed by each unit type separately. We compared the regression equation **B** weights, and examined plots of predicted performance (under the same ITI and turnover scenario), for two pairs of tasks for each unit type. These were pairs of tasks that were grouped during early stages of the cluster analysis process.

We concluded that there were some similarities between the regression equations for each pair of tasks, but that the differences were large enough that different training recommendations would be made for each task, based on applying the regression equations. Therefore, the same regression equation cannot be used to make predictions for more than one task, based on inherent similarities between the equations for different tasks.

DECISION MODEL AND USER GUIDANCE

This section of the report presents the general model for collective training decisions developed in this study. Following the presentation of the model, the user guidance developed to support collective task decisions at each stage of the model is described.

A Conceptual Model of Collective Training Decisions

There are three sequential stages in the collective training decision process. They are:

1. Identify the collective tasks and organizational elements (Platoons, Squads or Crews, etc.) for which training is required.
2. Develop a training strategy that will provide the required training.
3. Select appropriate training modes to execute the training strategy.

Each stage has several subordinate considerations that lead to decisions. These are discussed in the following paragraphs.

Identifying Training Requirements

For each collective task and organizational element, the training planner must reach a decision (either overt or implied) as to whether training is needed for that element and task. Training planners consider some or all of the following factors when making training requirements decisions.

1. When did each element last train on each task?
2. What was the element's level of proficiency on the task at that time?
3. What turnover has taken place in the element since that time?
4. What is the most likely effect of time since training and turnover on the element's proficiency on the task?
5. Does this mean that training is required?

When the decisions have been made for each element and collective task, the training planner develops a training strategy.

Developing the Training Strategy

The training strategy is developed to satisfy the training needs identified in the previous phase. A training strategy identifies which elements and tasks will be trained, the order in which training will take place, and the schedule for carrying out the training. The training strategy must accommodate external constraints, such as large-scale training cycles, training events planned at higher echelons, and training requirements imposed by higher authority. To develop an efficient training strategy, training planners should consider the following factors:

1. Practicing lower-echelon collective tasks that support larger numbers of higher-echelon collective tasks can result in greater training efficiency, since elements of more higher-echelon tasks will be practiced when training takes place on the lower-echelon tasks.
2. Lower echelons' (*e.g.*, Squad or Crew) proficiency on lower-echelon or prerequisite collective tasks should be sufficiently high that there is benefit from practicing higher-echelon (*e.g.*, Platoon) collective tasks. Low levels of collective-task proficiency on the part of lower echelon elements may need to be dealt with before training can take place on higher-echelon collective tasks.
3. Collective task performance depends on both individual-task and collective skills. If unit members are not proficient in individual-task skills, then there may be little benefit from collective-task training. Low levels of individual-task proficiency on the part of unit members may need to be dealt with before training can take place on collective tasks.

Selecting Training Modes to Implement the Training Strategy

Implementing the training strategy requires the training planner to select training modes appropriate to individual soldiers' and elements' levels of proficiency. Not all training modes are appropriate for all types of training. In selecting training modes, training planners should consider the following factors:

1. Elements or individuals at lower levels of proficiency should concentrate on developing proficiency on lower-echelon or prerequisite tasks. Training on higher-echelon or more advanced tasks should await development of the prerequisite skills at lower echelons or under basic conditions. If proficiency is low, then overall, simpler and less costly training modes should be preferred.
2. When proficiency is at higher levels, sustainment of skills and integration of multiple collective tasks into mission performance is appropriate. More costly and resource-intensive training modes may be needed to implement training with this emphasis.
3. Safety, as well as the level of proficiency, may constrain the training modes selected. For instance, units should develop proficiency on particular tasks in daylight before training on the same tasks at night. Night training increases the

difficulty of performing many tasks, and imposes risks that are more severe than during daylight training.

The user guidance developed in this research provides support for each of the three stages of collective training decisions. This guidance is described in the remainder of this section of the report.

User Guidance

The user guidance provides different types of support to users for each stage of the decision model. The following paragraphs describe the support provided for each stage.

Support for Identifying Collective Training Requirements

Support for identifying collective training requirements is provided by a set of look-up tables and recommended procedures for gathering the data needed to use the tables. Each look-up table provides training need statements⁴ for 36 combinations of ITI and turnover, for one collective task. The ITI values in the tables range from 1 to 6 months; the turnover values range from 10 to 60 percent. An example look-up table is shown in Table 25.

To use the look-up tables, the training planner determines the number of months since an element (*e.g.*, a Light Infantry Platoon) has trained on a particular collective task, and the amount of turnover that has taken place in the element during that interval. These values are then used to enter the appropriate look-up table and identify the level of training need for the task. Training needs are stated as "High," "Moderate," or "Low" for each ITI-turnover combination in the look-up tables. The training planner can use the look-up tables to identify collective task training needs for each collective task and element that is of interest. The information from the look-up tables can then be combined with other proficiency and training need information, to support the Commander's assessment of training requirements.

Accompanying the look-up tables are recommended procedures for gathering and recording the information on ITI and turnover that is needed to use the tables. Simple recording forms are also provided for ITI and turnover record-keeping.

Software Implementation of Regression Equations. An alternate method of determining collective training task needs, or priorities, was also developed. This method is a computer software routine that takes uses the original regression equations to compute a training need value for each collective task performed by a unit type. The routine requires information on the number of months

⁴ The look-up tables were developed by using simplified versions of the regression equations. We determined the total amount of turnover in each unit type for each SME-estimation scenario, and computed for each task a simplified regression equation with only three terms: a constant, a term for ITI, and a term for turnover. We then applied the simplified equations for each task, using the 36 combinations of ITI and turnover, to get an estimate of the likelihood of "T" performance for each combination. When all the computations were complete, we determined the distribution of "likelihood of 'T'" scores across all the collective tasks for each unit type. We found the 33rd and 66th percentiles of this distribution, and used these values to make the training need statements for each combination of ITI and turnover. "Likelihood of 'T'" values below the 33rd percentile of the distribution were given "High" training need statements. Values between the 33rd and 66th percentiles were given "Moderate" training need statements. Values above the 66th percentile were given "Low" training need statements.

Table 25

Example of Collective Training Need Look-up Table Included in User Guidance

Unit Type: Light Infantry Platoon**Collective Task: Breach Obstacle**

Months since task was last trained	Unit turnover during the period	Training need for this task
1	10 percent	Low
	20 percent	Low
	30 percent	Low
	40 percent	Low
	50 percent	Moderate
	60 percent	Moderate
2	10 percent	Low
	20 percent	Low
	30 percent	Low
	40 percent	Moderate
	50 percent	Moderate
	60 percent	High
3	10 percent	Low
	20 percent	Low
	30 percent	Moderate
	40 percent	Moderate
	50 percent	Moderate
	60 percent	High
4	10 percent	Low
	20 percent	Moderate
	30 percent	Moderate
	40 percent	Moderate
	50 percent	High
	60 percent	High
5	10 percent	Low
	20 percent	Moderate
	30 percent	Moderate
	40 percent	High
	50 percent	High
	60 percent	High
6	10 percent	Moderate
	20 percent	Moderate
	30 percent	Moderate
	40 percent	High
	50 percent	High
	60 percent	High

since each task was last trained, and total turnover levels over the last 1 to 6 months for an element. The routine produces a list of collective tasks performed by the unit type, with each task given a training need priority value that can range from 0 to 100. For Platoon unit types, lists of supporting lower-echelon collective tasks—also accompanied by training need priority values—are produced for each lower-echelon element, if ITI and turnover data have been provided for the lower-echelon unit types. The routine can also provide lists of supporting individual tasks, with training need priority values, for each echelon. This is optional. The training need priority values for individual tasks are based on the training need priorities of the collective tasks that are supported by each individual task.

The software routine—named CTNA (Collective Training Needs Assessment)—makes training need estimates for all the Platoons and Squads or Crews in a Company in one execution. It can maintain multiple sets of ITI and turnover data, so that (*e.g.*) a Battalion or Brigade would need only one copy of the software. The one copy could be used by many subordinate Companies to make training need estimates. The Army Research Institute currently has custody of the CTNA software.

At some time in the future, it may be feasible to integrate some version of this software routine into the Standard Army Training System—SATS—to extend the capabilities of SATS to making training need estimates for echelons below the Company level. If this is to be done, regression equations that describe collective skills loss due to ITI and turnover for collective tasks for other unit types will have to be developed.

Support for Developing the Training Strategy

Two types of information are provided to support training planners in developing a training strategy. The first is a set of factors that should be considered when developing the training strategy, with a discussion of why it may be important to consider each factor. These factors supplement the guidance to training planners provided by the 25- series FMs. The second type of information consists of the lists of Squad-level tasks that support each Platoon collective task, for Light and Mechanized Infantry Platoons. The lists of supporting tasks are provided because one of the factors to consider in developing a training strategy is the supporting relationships between lower- and higher-echelon collective tasks. This information is not presently provided by the training matrixes in the AMTPs for these unit types.

Support for Selecting Training Modes

User guidance to assist in selecting training modes is provided by a single table. This table is presented as Table 26, for reference. The table identifies training modes that are appropriate for different types of emphasis in the training strategy. It also provides information about the relative training time and resources required for each training mode, and identifies conditions of collective task proficiency where each training mode may be appropriate. In user guidance, the table is accompanied by brief instructions for its use.

Table 26

Guidance for Selecting Training Modes

If your training strategy emphasizes this kind of training:	Then this training mode may be appropriate:	But consider training time and resources cost:	And collective task proficiency of units to be trained:
Introducing basics	Classroom/Demonstration/-Practice (Single echelon training under basic conditions)	Lowest cost and least resources required; safety seldom a concern	Appropriate when overall proficiency is low and personnel need introduction to basics
Practicing basics; introducing more advanced elements and building teamwork	Talk-through/walk-through, MAPEX, sand table training (Develop and improve proficiency on collective tasks)	Low cost, few resources required; safety a minor concern	Appropriate when units are proficient on some tasks but proficiency must be developed for others
Practicing elements of tasks	Device-based training (if devices, e.g. COFT, are available) (Improve and sustain proficiency)	Relatively low cost, device resources required; safety usually not a concern	Appropriate when units need to sustain and improve skills, and devices are available
Learn and practice teamwork and decision making in collective tasks	Situational Training Exercises (STX)/ Tactical Exercises Without Troops (TEWT)/Terrain Walk (Develop and improve collective task proficiency)	Somewhat higher cost and longer leadtime needed; more detailed planning required; safety a concern	Appropriate for introducing more difficult conditions when proficiency in basics is established
Sustain proficiency	Field Training Exercises (FTX), using dry-fire or MILES (Sustain proficiency in performing collective tasks)	High cost, long leadtimes needed, detailed planning a must; safety a significant concern	Appropriate when units are proficient at collective tasks under all conditions
Confirm training effectiveness where live-fire is necessary	Live Fire Exercises (LFX) (Confirm that units perform proficiently under all conditions)	Very high dollar and resource cost, long leadtimes required, safety a major concern	Appropriate to confirm training effectiveness and proficiency on tasks that require weapons firing

DISCUSSION

The overall scientific objective of this research was achieved. A method was developed for predicting collective skills loss as a result of ITI and turnover. The method was applied to develop user guidance for making decisions about the need for collective task training. This guidance can assist the primary users—unit training planners—to effectively and efficiently identify collective task training needs. The user guidance can also help unit training planners create training strategies to efficiently obtain the needed training, and to select appropriate modes for carrying out the training strategy.

Some of the intermediate results from elements of the research may be used by other categories of Army users. The SME estimation method for estimating collective skills loss and performance decrements may be used by training developers in the TRADOC schools to predict collective skills loss for collective tasks performed by unit types other than those that were the focus of this work. This can lead to providing user guidance for collective training decisions to training planners in other unit types. Such information could be provided as a supplement to existing AMTPs, or it might be prepared as separate companion documents to AMTPs. This information could also be used to develop recommended sustainment training intervals for collective tasks, which could be added to the training matrixes in AMTPs.

TRADOC school personnel may also perform analyses to identify the lower-echelon collective tasks that support specific higher-echelon collective tasks, as we did in this effort. This information should be added to AMTPs to supplement the individual-task-to-collective task matrices that are now provided. This would make the AMTP a more comprehensive reference for the unit training planner.

The categorization schemes developed in this research may also be used by other users. Once the unit-type and collective-task schemes have been more thoroughly validated with other unit types and collective tasks, the CTEP scores for collective tasks can be used as indicators of both the relative need for frequent sustainment training and of task performance difficulty. Evidence for the validity of the CTEP for both these purposes was found in this work.

Since we used influence on the amount a unit must learn and remember as a criterion for selecting factors for the categorization schemes, the CTEP may also be used as an indicator of training difficulty for collective tasks. We did not validate this aspect of the CTEP in this research. Additional study will be needed to determine if the CTEP is a valid indicator of collective task learning difficulty. If the CTEP proves valid for this purpose, it can be used to assist in training program design. For instance, tasks with high CTEP numeric scores may require larger numbers of training iterations for units to become proficient in performing the tasks. This information can provide additional assistance to unit training planners in choosing appropriate training modes. Tasks that require more iterations to build proficiency should be scheduled for training when longer periods of training time are available, or when training resources are most likely to be available to support large numbers of iterations. Training modes with these features (*i.e.*, Field Training Exercises, or FTXs) are less likely to be under the control of small-unit training planners. Therefore, planning to train tasks that require many iterations to proficiency may require careful coordination so as to be included in training events that are planned and scheduled by higher echelons.

Information about sustainment training frequency can be useful both in training planning and in unit design or re-design. As the Army redefines its force structure, planners in the TRADOC schools should consider the sustainment training implications of the constellations of collective tasks assigned to both existing and proposed unit types. This information can be used by applying the collective-task categorization scheme, and summarizing the CTEP scores assigned to the collective tasks for a unit design. This can lead to identifying where sustainment training needs may not be able to be met by traditional training approaches. In turn, this can lead to specifying needs to provide non-traditional training opportunities to support both existing and new unit types, including devices, simulators, and simulations. This is in line with the emphasis of the evolving Combined Arms Training Strategy, or CATS.

The UTEP may also be useful in evaluating possible changes to unit design, or making trade-offs between candidate unit designs in terms of training implications. We found evidence that the UTEP score for unit types is related to the rate of collective skills loss for a unit type. Computing and comparing UTEP scores for different candidate unit structures can provide information about overall needs for sustainment training for each candidate design. This could be used to evaluate the supportability of different unit designs, from a sustainment training-requirements perspective.

The categorization scheme that we developed for specific units of a given type was not applied or validated in this research. This scheme could be developed into another tool for the unit training planner. Information about the extent to which specific units at a given echelon are likely to have had the greatest amount of collective skills loss could assist planners in setting priorities for training specific units, when training cannot be provided for all units. Information of this kind is implied in summaries of CTEP scores across all the collective tasks performed by a specific units, but it is not explicit. It may be more straightforward to apply the categorization scheme for specific units than to summarize CTEP scores. This will require application and validation of the specific-unit categorization scheme.

A combination of the CTEP scores and knowledge about which lower-echelon collective tasks support particular higher-echelon collective tasks can be used by Department of the Army mobilization planners. This information can help identify efficient sequences for training. As suggested in the user guidance for unit training planners, benefits in training efficiency can be gained by training lower-echelon tasks that support many higher-echelon tasks. In this way, some elements of all the higher-echelon tasks are trained. This can lead to more efficient training. In combination with information about the required frequency of sustainment training—derived from collective tasks' CTEP scores—this can assist in the design of training plans to bring mobilizing units to proficiency quickly and sustain their proficiency once it is established.

UTEP information may assist mobilization planners in setting priorities for training resources across unit types. If the UTEP is validated as an indicator of the relative difficulty of skills acquisition for a unit type, UTEP scores can be used to identify which unit types will require the most training time and resources to develop collective skills proficiency. This information may assist in the process of allocating limited resources to unit types, when more than one unit type must be trained.

The guidance developed for training mode selection in this work can be applied to any small-unit training; it is not restricted to the unit types on which our work was focused. It may be feasible to quickly export this guidance to training planners to supplement the guidance that is now provided. This could provide a near-term payoff from the research.

AMTPs as a Data Source

The T&EO task descriptions in the AMTPs for unit types were used as the primary source for collective-task descriptive information in this research. These task descriptions have some shortcomings, particularly for use as a data source for applying the collective-task categorization scheme and doing the SME performance estimation task. The most notable is the variable level of specificity about what sub-teams exist and what different activities they are doing, both from subtask to subtask in the same T&EO and in different T&EOs in the same AMTP. Some T&EOs present alternate ways of performing a task, rather than describing the task-organization and activities of a unit doing the task. Finally, the level of specificity in the T&EOs about subtasks, and sub-teams' identity and activities, varies from one AMTP to another, as mentioned earlier in this report. Overall, the level of task-descriptive detail in the T&EOs is less than is desirable to support the methods used in this research. More consistent levels of detail and specificity, particularly about sub-teams and their differing activities, could improve the AMTPs as a data source for the kinds of analyses we performed.

Implications of Findings for Army Training and Personnel Management

The results of this research have specific implications for both training and personnel management issues. First, there is a direct and quantifiable trade-off between the effects of time since training and turnover on the need to provide collective training. Both factors cause collective skills loss, and the effect of turnover seems to potentiate, or increase, the effect of time without training. To minimize the need for collective training, turnover should be minimized. If turnover cannot be minimized, then there will be more frequent needs for collective training. This means that either overall training costs and resource requirements will be higher, or units will have a more or less permanent deficit in collective skills, depending on whether the needed training can be provided.

This may be a more critical issue for units that have immediate deployment commitments (e.g., units in the Rapid Deployment Force and special operations units). Such units have less opportunity for pre-deployment unit training to hone collective skills—they must have the needed skills continuously. Therefore, personnel stability in such units should be maximized, if possible, to assist units in maintaining the highest possible levels of readiness. The maximum amount of training time should also be routinely made available to units that may have to deploy rapidly, to prevent deterioration of collective skills.

The relative magnitude of turnover effects between leader and non-leader positions has implications for where efforts to stabilize unit membership will have the most benefit. The combined effects of senior and junior leader turnover on performance account for about 80 percent of the total effect of turnover, in our data. Non-leader turnover had a relatively insignificant effect on performance. This implies that stabilizing leadership positions in units will go some distance toward reducing the required frequency of training for collective skills sustainment. We speculate that this could also result in additional benefits, in terms of improved unit morale and cohesion, and better retention of "institutional memory" among unit members.

Recommendations for Further Research

As mentioned, this research is a first step toward providing comprehensive guidance that supports many aspects of unit training planning. Additional work should build on the foundation provided by our results and methods. The first step in doing so should be to gather empirical data on collective task performance in the unit types studied in this work.⁵ These data should be used to validate the regression equations developed in this work, or to develop new regression equations to predict collective skills loss. The data should also be used to further validate the unit-type and collective-task categorization schemes, and update and improve them if necessary.

The user guidance materials developed in this research should be tested with a sample of actual unit training planners. This testing should focus on the usability and relevance of the information and guidance that is provided. It should also identify parts of the unit training planning process where additional guidance or information would be useful. The results of the user tests should be used to revise and improve the user guidance, and extend the guidance to provide more comprehensive support for training planners.

The use of some of the intermediate products from this research with users other than unit training planners, discussed in the first part of this section, should also be explored. Personnel in the TRADOC schools should test the usability of the SME estimation methods used in this work, using active-duty Army personnel as SMEs. The procedures for applying the unit-type and collective-task categorization schemes should also be tested for usability by Army personnel.

Unit training planners should attempt to apply the specific-unit categorization scheme developed in this research, both to validate the scheme and to determine if it provides useful information that assists in training planning.

Work should also be done to validate the UTEP and CTEP as predictors of the difficulty of collective skills acquisition. If they are so validated, they can be used as an aid to selecting appropriate training modes. Validation of the UTEP and CTEP as acquisition predictors can also lead to their use in planning mobilization training, as discussed above.

Finally, the CTNA software routine for applying the regression equations to make collective training need estimates should be evaluated for integration with a future version of SATS. This routine may provide a way to extend the some of the benefits of SATS to training planners below the Company echelon.

⁵

Data elements should include as a minimum task performance scoring (per T&EO criteria) for each iteration of each collective task performed by units, training dates for each collective task (used to compute ITTs), and detailed records of turnover in unit membership.

REFERENCES

- Bass, B. (1982). Individual capability, team performance, and team productivity. In: M.D. Dunnette and E.A. Fleishman (Eds.), *Human performance and productivity: Human capability assessment*. Hillsdale, N.J.: Lawrence Erlbaum Associates.
- Cannon-Bowers, J.A., Salas, E., and Converse, S.A. (1990). Cognitive psychology and team training: Training shared mental models of complex systems. *Human Factors Society Bulletin*, December 1990, 1-4.
- Coovert, M.D., Cannon-Bowers, J.A., and Salas, E. (1990). Applying mathematical modeling technology to the study of team training and performance. In: *Proceedings of the 12th Annual Interservice/Industry Training Systems Conference*. Washington, D.C.: American Defense Preparedness Association, 1990.
- Denson, R.W. (1981). Team training: Literature review and annotated bibliography (AFHRL-TR-80-40). Wright-Patterson Air Force Base, OH: Logistics and Technical Training Division, Air Force Human Resources Laboratory.
- Department of the Army (1988). Training the Force. Field Manual (FM) 25-100. Washington, D.C.: Headquarters, Department of the Army, November, 1988.
- Department of the Army (1984a). Unit Training Management. Field Manual (FM) 25-2. Washington, D.C.: Headquarters, Department of the Army, September, 1984.
- Department of the Army (1984b). Training in Units. Field Manual (FM) 25-3. Washington, D.C.: Headquarters, Department of the Army, December, 1984.
- Department of the Army (1984c). How to Conduct Training Exercises. Field Manual (FM) 25-3. Washington, D.C.: Headquarters, Department of the Army, September, 1984.
- Dyer, J.L. (1984). Team research and team training: A state-of-the-art review. In: F.A. Muckler (Ed.) *Human Factors Review: 1984*. Santa Monica, CA: Human Factors Society.
- Farr, M.J. (1986). The long-term retention of knowledge and skills: A cognitive and instructional perspective (IDA Memorandum Report M-205). Alexandria, VA: Institute for Defense Analyses. (DTIC No. AD A175 905)
- Freeberg, N.E. and Rock, D.A. (1987). Development of a small-group team performance taxonomy based on meta-analysis. Princeton, N.J.: Educational Testing Service.
- Goldin, S.E. and Thorndyke, P.W. (Eds.) (1980). Improving team performance: Proceedings of the Rand team performance workshop (R-2606-ONR). Santa Monica, CA: Rand Corporation.

- Hall, E.R., Ford, L.H., Whytten, T.C., and Plyant, L.R. (1983). Knowledge retention among graduates of basic electricity and electronics schools. Orlando, FL: Training Analysis and Evaluation Group, 1983. (DTIC No. AD A131 855)
- Kirk, R.E. (1968). *Experimental Design: Procedures for the Behavioral Sciences*. Belmont, CA: Brooks-Cole, 1968.
- Lane, N.E. (1986). Skill acquisition curves and military training (IDA Paper P-1945). Alexandria, VA: Institute for Defense Analyses.
- PRC (Planning Research Corporation) (1989). Extracts from data collected during a study of factors that influence unit performance in a simulated combat environment. Monterey, CA: Planning Research Corporation.
- Rose, A.M., Czarnolewski, M.Y., Gragg, F.E., Austin, S.H., Ford, P., Doyle, J., and Hagman, J.D. (1984). Acquisition and retention of soldiering skills (AIR Final Report FR88600). Washington, D.C.: American Institutes for Research.
- Rose, A.M., Radtke, P.H., Shettel, H.H., and Hagman, J.D. (1985). User's manual for predicting military skill retention (Report No. AIR FR37800). Washington, D.C.: American Institutes for Research.
- Roth, J. T. (1990). Training in MLRS units. Final report submitted to the U.S. Army Research Institute for the Behavioral and Social Sciences, Presidio of Monterey Field Unit. Butler, PA: Applied Science Associates, Inc., September, 1990.
- Salas, E., Dickinson, T.L., Converse, S.A., and Tannenbaum, S.I. (in press). Toward an understanding of team performance and training. In: R. W. Swezey and E. Salas (Eds.) *Teams: Their Training and Performance*. Norwood, N.J.: ALEX (in press).
- Stout, R., Cannon-Bowers, J. A., Morgan, Jr., B. B., and Salas, E. (1989). The development of a scale to assess the teamwork needs of training situations. In: *Proceedings of the Human Factors Society 33rd Annual Meeting*. Santa Monica, CA: Human Factors Society, 1989.
- Siegel, S. (1956). *Nonparametric statistics for the behavioral sciences*. New York: McGraw-Hill.
- Williams, W.M. and Sternberg, R.J. (no date). Group intelligence: Why some groups are better than others. Unpublished manuscript, Department of psychology, Yale University.

ACRONYMS AND ABBREVIATIONS

AFQT	Armed Forces Qualification Test
AMTP, AMTPs	ARTEP Mission Training Plan(s)
ANOVA(s)	Analysis(es) of Variance
ARTEP	Army Training and Evaluation Program
CALFEX	Combined Arms Live Fire Exercise
CATS	Combined Arms Training Strategy
COFT	Conduct of Fire Trainer
CTC	Combat Training Center
CTEP	Collective Task Effects Prediction
DA	Department of the Army
FM, FMs	Field Manual(s)
FORSCOM	United States Army Forces Command
FTX, FTXs	Field Training Exercise(s)
ITI	inter-Training Interval
JRTC	Joint Readiness Training Center
LFX	Live Fire Exercise
MAPEX	Map Exercise
METL, METLs	Mission Essential Task List(s)
METT-T	Mission, Enemy Situation, Troops, Terrain and Weather, and Time Available (for planning)
MILES	Multiple Integrated Laser Engagement System
MLRS	Multiple Launch Rocket System

MOS	Military Occupational Specialty (-ies)
NCO(s)	Noncommissioned Officer(s)
NTC	National Training Center
SATS	Standard Army Training System
SME, SMEs	Subject Matter Expert(s)
STX, STXs	Situational Training Exercise(s)
T&EO, T&EOs	Training and Evaluation Outline(s)
TEWT, TEWTs	Tactical Exercise(s) Without Troops
TOE	Tables of Organization and Equipment
TRADOC	U.S. Army Training and Doctrine Command
UTEP	Unit Type Effects Prediction
WTS, WTSs	Weekly Training Schedule(s)

APPENDIX A

COLLECTIVE TASKS IN AMTPs EXCLUDED IN THIS RESEARCH

EXCLUDED TASKS

Some collective tasks described in the AMTPs for the five unit types were excluded from the SME estimation task and the application of collective task factors. The primary reason that any task was excluded from the analyses was inability of the analysts to develop a clear understanding of the task and what is done by a unit in performing the task. Analysts cited two major problems with T&EO task descriptions: (1) too low a level of detail; and (2) inconsistency in level of detail from T&EO subtask to subtask. A third problem sometimes mentioned was that a task "description" for some tasks consists of a recital of alternative approaches to doing a task—not a description of how a unit goes about performing the task.

The following tasks were excluded from the analyses.

Armor Platoon Tasks

No tasks were excluded.

Mechanized Infantry Platoon Tasks

Prepare a Defensive Position (MOUT): excluded from both analyses.

Light Infantry Platoon Tasks

Assault Mounted: excluded from both analyses.

Cross Defile: excluded from both analyses.

Perform Vehicle Operations: excluded from both analyses.

Light Infantry Squad Tasks

Assault Mounted: excluded from both analyses.

Mechanized Infantry Squad Tasks

Consolidate and Reorganize: excluded from both analyses.

APPENDIX B

CHARACTERISTICS OF PERFORMANCE ESTIMATION SCENARIOS USED BY SMES TO ESTIMATE PERFORMANCE CHANGE

This Appendix presents five Tables that describe the characteristics of the scenarios used by SMEs to develop the collective task performance estimates in the research. Each Table includes the following information for each scenario:

1. Scenario reference number
2. Number of months since training
3. Description of non-leader turnover
4. Description of junior leader turnover
5. Description of senior leader turnover.

The number of personnel in each category is presented at the beginning of the personnel changes columns in each Table.

Table B-1

Performance Estimation Scenarios for Armor Platoon Collective Tasks

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N = 12)	Junior Leaders (N = 2)	Senior Leaders (N = 2)
1	1	Four soldiers	None	None
2	2	Four soldiers	None	None
3	4	Four soldiers	None	None
4	6	Four soldiers	None	None
5	1	Nine Soldiers	None	None
6	2	Nine Soldiers	None	None
7	4	Nine Soldiers	None	None
8	6	Nine Soldiers	None	None
9	1	Five Soldiers	None	Platoon Leader
10	2	Five Soldiers	None	Platoon Leader
11	4	Five Soldiers	None	Platoon Leader
12	6	Five Soldiers	None	Platoon Leader
13	1	Eight Soldiers	None	Platoon Sergeant
14	2	Eight Soldiers	None	Platoon Sergeant
15	4	Eight Soldiers	None	Platoon Sergeant
16	6	Eight Soldiers	None	Platoon Sergeant
17	1	Four Soldiers	None	Platoon Leader Platoon Sergeant
18	2	Four Soldiers	None	Platoon Leader Platoon Sergeant
19	4	Four Soldiers	None	Platoon Leader Platoon Sergeant
20	6	Four Soldiers	None	Platoon Leader Platoon Sergeant
21	1	Nine Soldiers	None	Platoon Leader Platoon Sergeant
22	2	Nine Soldiers	None	Platoon Leader Platoon Sergeant
23	4	Nine Soldiers	None	Platoon Leader Platoon Sergeant
24	6	Nine Soldiers	None	Platoon Leader Platoon Sergeant
25	1	None	None	None
26	2	None	None	None
27	4	None	None	None
28	6	None	None	None

Table B-2**Performance Estimation Scenarios for Mechanized Infantry Platoon Collective Tasks**

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N=23)	Junior Leaders (N=6)	Senior Leaders (N=3)
1	1	Seven soldiers	None	None
2	2	Seven soldiers	None	None
3	4	Seven soldiers	None	None
4	6	Seven soldiers	None	None
5	1	Twelve soldiers	None	None
6	2	Twelve soldiers	None	None
7	4	Twelve soldiers	None	None
8	6	Twelve soldiers	None	None
9	1	Seven soldiers	Two NCOs	None
10	2	Seven soldiers	Two NCOs	None
11	4	Seven soldiers	Two NCOs	None
12	6	Seven soldiers	Two NCOs	None
13	1	Twelve soldiers	Two NCOs	None
14	2	Twelve soldiers	Two NCOs	None
15	4	Twelve soldiers	Two NCOs	None
16	6	Twelve soldiers	Two NCOs	None
17	1	Seven soldiers	None	Platoon Leader
18	2	Seven soldiers	None	Platoon Leader
19	4	Seven soldiers	None	Platoon Leader
20	6	Seven soldiers	None	Platoon Leader
21	1	Twelve soldiers	None	Platoon Sergeant
22	2	Twelve soldiers	None	Platoon Sergeant
23	4	Twelve soldiers	None	Platoon Sergeant
24	6	Twelve soldiers	None	Platoon Sergeant
25	1	Seven soldiers	Five NCOs	None
26	2	Seven soldiers	Five NCOs	None
27	4	Seven soldiers	Five NCOs	None
28	6	Seven soldiers	Five NCOs	None

(Continued on next page)

**Table B-2
(Concluded)**

Performance Estimation Scenarios for Mechanized Infantry Platoon Collective Tasks

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N=23)	Junior Leaders (N=6)	Senior Leaders (N=3)
29	1	Twelve soldiers	Five NCOs	None
30	2	Twelve soldiers	Five NCOs	None
31	4	Twelve soldiers	Five NCOs	None
32	6	Twelve soldiers	Five NCOs	None
33	1	Seven soldiers	Two NCOs	Platoon Leader
34	2	Seven soldiers	Two NCOs	Platoon Leader
35	4	Seven soldiers	Two NCOs	Platoon Leader
36	6	Seven soldiers	Two NCOs	Platoon Leader
37	1	Twelve soldiers	Two NCOs	Platoon Sergeant
38	2	Twelve soldiers	Two NCOs	Platoon Sergeant
39	4	Twelve soldiers	Two NCOs	Platoon Sergeant
40	6	Twelve soldiers	Two NCOs	Platoon Sergeant
41	1	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
42	2	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
43	4	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
44	6	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
45	1	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
46	2	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
47	4	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
48	6	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
49	1	None	None	None
50	2	None	None	None
51	4	None	None	None
52	6	None	None	None

Table B-3**Performance Estimation Scenarios for Light Infantry Platoon Collective Tasks**

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N = 23)	Junior Leaders (N = 9)	Senior Leaders (N = 2)
1	1	Seven soldiers	None	None
2	2	Seven soldiers	None	None
3	4	Seven soldiers	None	None
4	6	Seven soldiers	None	None
5	1	Twelve soldiers	None	None
6	2	Twelve soldiers	None	None
7	4	Twelve soldiers	None	None
8	6	Twelve soldiers	None	None
9	1	Seven soldiers	Two NCOs	None
10	2	Seven soldiers	Two NCOs	None
11	4	Seven soldiers	Two NCOs	None
12	6	Seven soldiers	Two NCOs	None
13	1	Twelve soldiers	Two NCOs	None
14	2	Twelve soldiers	Two NCOs	None
15	4	Twelve soldiers	Two NCOs	None
16	6	Twelve soldiers	Two NCOs	None
17	1	Seven soldiers	None	Platoon Leader
18	2	Seven soldiers	None	Platoon Leader
19	4	Seven soldiers	None	Platoon Leader
20	6	Seven soldiers	None	Platoon Leader
21	1	Twelve soldiers	None	Platoon Sergeant
22	2	Twelve soldiers	None	Platoon Sergeant
23	4	Twelve soldiers	None	Platoon Sergeant
24	6	Twelve soldiers	None	Platoon Sergeant
25	1	Seven soldiers	Five NCOs	None
26	2	Seven soldiers	Five NCOs	None
27	4	Seven soldiers	Five NCOs	None
28	6	Seven soldiers	Five NCOs	None

(Continued on next page)

**Table B-3
(Concluded)**

Performance Estimation Scenarios for Light Infantry Platoon Collective Tasks

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N=23)	Junior Leaders (N=9)	Senior Leaders (N=2)
29	1	Twelve soldiers	Five NCOs	None
30	2	Twelve soldiers	Five NCOs	None
31	4	Twelve soldiers	Five NCOs	None
32	6	Twelve soldiers	Five NCOs	None
33	1	Seven soldiers	Two NCOs	Platoon Leader
34	2	Seven soldiers	Two NCOs	Platoon Leader
35	4	Seven soldiers	Two NCOs	Platoon Leader
36	6	Seven soldiers	Two NCOs	Platoon Leader
37	1	Twelve soldiers	Two NCOs	Platoon Sergeant
38	2	Twelve soldiers	Two NCOs	Platoon Sergeant
39	4	Twelve soldiers	Two NCOs	Platoon Sergeant
40	6	Twelve soldiers	Two NCOs	Platoon Sergeant
41	1	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
42	2	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
43	4	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
44	6	Six soldiers	Two Squad Leaders Three NCOs	Platoon Leader
45	1	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
46	2	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
47	4	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
48	6	Thirteen soldiers	One Squad Leader Four NCOs	Platoon Sergeant
49	1	None	None	None
50	2	None	None	None
51	4	None	None	None
52	6	None	None	None

Table B-4

Performance Estimation Scenarios for Light Infantry Squad Collective Tasks

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N=6)	Junior Leaders (N=2)	Senior Leaders (N=1)
1	1	Two soldiers	None	None
2	2	Two soldiers	None	None
3	4	Two soldiers	None	None
4	6	Two soldiers	None	None
5	1	Five soldiers	None	None
6	2	Five soldiers	None	None
7	4	Five soldiers	None	None
8	6	Five soldiers	None	None
9	1	Two soldiers	One NCO	None
10	2	Two soldiers	One NCO	None
11	4	Two soldiers	One NCO	None
12	6	Two soldiers	One NCO	None
13	1	Five soldiers	One NCO	None
14	2	Five soldiers	One NCO	None
15	4	Five soldiers	One NCO	None
16	6	Five soldiers	One NCO	None
17	1	One soldier	One NCO	Squad Leader
18	2	One soldier	One NCO	Squad Leader
19	4	One soldier	One NCO	Squad Leader
20	6	One soldier	One NCO	Squad Leader
21	1	Four soldiers	Two NCOs	None
22	2	Four soldiers	Two NCOs	None
23	4	Four soldiers	Two NCOs	None
24	6	Four soldiers	Two NCOs	None
25	1	None	None	None
26	2	None	None	None
27	4	None	None	None
28	6	None	None	None

Table B-5

Performance Estimation Scenarios for Mechanized Infantry Squad Collective Tasks

Scenario Reference	No. of Months Since Training	Personnel Changes Described		
		Non-leaders (N=7)	Junior Leaders (N=1)	Senior Leaders (N=1)
1	1	Two soldiers	None	None
2	2	Two soldiers	None	None
3	4	Two soldiers	None	None
4	6	Two soldiers	None	None
5	1	Five soldiers	None	None
6	2	Five soldiers	None	None
7	4	Five soldiers	None	None
8	6	Five soldiers	None	None
9	1	Two soldiers	One NCO	None
10	2	Two soldiers	One NCO	None
11	4	Two soldiers	One NCO	None
12	6	Two soldiers	One NCO	None
13	1	Five soldiers	One NCO	None
14	2	Five soldiers	One NCO	None
15	4	Five soldiers	One NCO	None
16	6	Five soldiers	One NCO	None
17	1	One soldier	One NCO	Squad Leader
18	2	One soldier	One NCO	Squad Leader
19	4	One soldier	One NCO	Squad Leader
20	6	One soldier	One NCO	Squad Leader
21	1	Four soldiers	Two NCOs	None
22	2	Four soldiers	Two NCOs	None
23	4	Four soldiers	Two NCOs	None
24	6	Four soldiers	Two NCOs	None
25	1	None	None	None
26	2	None	None	None
27	4	None	None	None
28	6	None	None	None

APPENDIX C

EXAMPLE ESTIMATION INSTRUCTIONS

This Appendix contains an example of the instructions that were given to SMEs for the estimation task. The same instructions were used for each unit type, with the appropriate unit type and number of scenarios information substituted in the instruction text. Following the example instructions is a sample of the response sheets used by SMEs to record their performance estimates.

INSTRUCTIONS FOR ESTIMATION TASK

We are asking you to estimate for us how well (*unit type title*) can perform collective tasks. We are interested in knowing how platoon performance on these tasks changes as a result of: (1) the amount of time since training on a particular collective task; and (2) turnover in the membership of the platoon.

To help you make estimates of platoon performance, we have developed (*number*) *scenarios* about time since training and changes in the membership of a fictional platoon. These scenarios are on the following pages in this booklet. Before you look at the scenarios, please read the rest of these instructions.

Assumptions

We want you to assume some things about the fictional platoon in these scenarios. First, assume that the platoon starts out with every member proficient in every individual task required by his MOS and skill level. That is, everyone can do the individual tasks required of him.

Second, assume that the platoon starts out at full strength. There is turnover in platoon membership in most scenarios, but the platoon is always at full strength at the time you make the estimate of performance.

Third, you should assume that the platoon performed well on the collective task you're considering the last time the platoon did the task. In the language of the ARTEP MTP, the platoon's performance was evaluated as "T," or trained, last time.

Fourth, assume that the platoon has not performed, trained, or practiced the collective task you're considering for the period of time listed in the scenario.

Your Task

Keeping these assumptions in mind, study each scenario in turn for a collective task on the list we've provided. As you study the scenario, pay special attention to the *amount of time since the platoon performed the task* and the *personnel changes that have occurred during that period of time*. Use the scenario to think about how the platoon's performance on the task will change over time without practice and changes in people.

Then, tell us how well the platoon would perform the task if they did the task today, given the conditions in the scenario and our assumptions. To do this, you will make an estimate of how the platoon would be rated in an externally evaluated ARTEP. You'll make your rating by assigning 100 points across the ARTEP rating categories: Trained (T), Needs Practice (P), and Untrained (U).

Here is an example of assigning points to the three rating categories:

T	P	U
50	30	20.

This example shows that an evaluator thought that the fictional platoon would have a 50 percent chance of being rated Trained, a 30 percent chance of being rated Needs Practice, and a 20 percent chance of being rated Untrained. You do not have to use all three rating categories for every estimate you make. For instance, if you think the platoon in a scenario would have a very good chance of being rated Trained, you could assign the 100 points like this:

T	P	U
90	10	0.

You'll indicate your ratings on one of the response sheets (in the other booklet) by writing in your assignment of points to the rating categories. You'll write in a set of point assignments for each scenario, for each collective task. Attached is an example of marking the response sheets.

Collective Task: _____

Evaluator Name: _____

Scenario: ARP-1			Scenario: ARP-2			Scenario: ARP-3			Scenario: ARP-4		
T	P	U	T	P	U	T	P	U	T	P	U
Scenario: ARP-5			Scenario: ARP-6			Scenario: ARP-7			Scenario: ARP-8		
T	P	U	T	P	U	T	P	U	T	P	U
Scenario: ARP-9			Scenario: ARP-10			Scenario: ARP-11			Scenario: ARP-12		
T	P	U	T	P	U	T	P	U	T	P	U
Scenario: ARP-13			Scenario: ARP-14			Scenario: ARP-15			Scenario: ARP-16		
T	P	U	T	P	U	T	P	U	T	P	U
Scenario: ARP-17			Scenario: ARP-18			Scenario: ARP-19			Scenario: ARP-20		
T	P	U	T	P	U	T	P	U	T	P	U
Scenario: ARP-21			Scenario: ARP-22			Scenario: ARP-23			Scenario: ARP-24		
T	P	U	T	P	U	T	P	U	T	P	U
Scenario: ARP-25			Scenario: ARP-26			Scenario: ARP-27			Scenario: ARP-28		
T	P	U	T	P	U	T	P	U	T	P	U

Armor Platoon Task Retention Estimation Form

APPENDIX D

INTER-RATER AGREEMENT COEFFICIENTS FOR SME PERFORMANCE ESTIMATION

This Appendix contains five tables that present the inter-rater agreement correlation coefficients computed between the 'percent "T"' scores derived from SME estimates. One table is presented per unit type for which performance estimate data were developed. The correlation coefficients for Mechanized Infantry and Light Infantry Platoon tasks are based on 52 cases each. The correlation coefficients for the other three unit types are based on 28 cases each.

Table D-1

Inter-Rater Agreement Correlation Coefficients
for Armor Platoon Collective Tasks' Performance Estimates

Collective Task Title	Inter-Rater Agreement Correlation Coefficient
Perform Tactical Planning	.8543
Prepare for Tactical Operations	.8693
Perform Precombat Checks	.9572
Perform Consolidation and Reorganization	.9769
Employ ECCM	.9670
Produce a Platoon Fire Plan	.8578
Employ Command and Control Measures	.9163
Perform Assembly Area Activities	.8276
Execute a Coil Formation	.9303
Execute a Herringbone Formation	.9597
Execute a Column Formation	.9802
Execute a Staggered Column Formation	.9800
Execute a Wedge Formation	.9660
Execute a Vee Formation	.9660
Execute a Line Formation	.9654
Execute a Echelon Formation	.9664
Execute Traveling	.9570
Execute Traveling Overwatch	.9157
Execute Bounding Overwatch	.9157
Conduct a Tactical Road March	.9568
Move in a Built-Up Area	.9589
Assist a Passage of Lines	.8885
Perform a Passage of Lines	.9518
Conduct Rehearsals for a Mission	.9348
Perform Platoon Fire and Movement	.9598
Perform Reconnaissance By Fire	.9693
Perform an Attack By Fire	.8285
Assault an Enemy Position	.9493
Execute Actions on Contact	.9179
Occupy a Platoon Battle Position	.9733
Displace to a Subsequent Battle Position	.9117
React to an Enemy Dismounted Attack	.9532
Execute a Platoon Defensive Mission	.9511
Assist a Relief in Place	.9599
Conduct Hasty Occupation of Battle Position	.9045
Employ Camo. and Countersurveillance Measures	.9730
Establish an Observation Post	.9555
Process Enemy Prisoners of War	.8977
Process Captured Documents and Equipment	.9309
Take Actions at an Obstacle	.9445
Execute a Prepared Obstacle	.9676
Construct a Hasty Obstacle	.9502
Emplace a Hasty Protective Minefield	.8480
Prepare for a Chemical Attack	.8917
Prepare for a Nuclear Attack	.8952
Prepare for a Friendly Nuclear Strike	.9304
Respond to Init. Effects of a Nuclear Attack	.8392
Respond to Residual Effects of Nuclear Attack	.9660
Cross a Radiologically Contaminated Area	.9670
Respond to a Chemical Agent Attack	.9662
Conduct a Chemical Reconnaissance	.9483
Cross a Chemically Contaminated Area	.8285
Perform Chemical Decontamination	.8807
Perform Resupply Operations	.9063
Prepare and Evacuate Casualties	.9599
Perform Maintenance Operations	.9459
Perform Field Sanitation Operations	.9601
Take Passive Air Defense Measures	.8876
Take Active Air Defense Measures	.9863
Battle Drill #1—Change Formation	.8864
Battle Drill #2—Action Drill	.9125
Battle Drill #3—Contact Drill	.9929
Battle Drill #4—Air Attack Drill	.9011
Battle Drill #5—React to Indirect Fire	.9019

Table D-2

Inter-Rater Agreement Correlation Coefficients
for Mechanized Infantry Platoon Collective Tasks' Performance Estimates

Collective Task Title	Inter-Rater Agreement Correlation Coefficient
Acquire Targets/Distribute Fire	.7027
Assault Dismounted (Raid)	.6160
Assault Mounted	.7414
Breach Obstacle	.5655
Change Formation (Mounted)	.7773
Clear a Building	.9473
Clear a Trench Line	.5283
Clear a Woodline	.7893
Conduct Aerial Resupply	.8418
Conduct an Anti-armor Ambush	.7661
Conduct Fire and Movement	.6560
Conduct a Hasty Ambush	.6498
Conduct Helicopter Movement	.8408
Conduct a Passage of Lines	.8289
Conduct a Point Ambush	.6141
Conduct Screen/Guard Operations	.7716
Conduct a Tactical Road March	.6551
Consolidate and Reorganize	.5642
Cross a Danger Area (Dismounted)	.8735
Cross a Defile	.8195
Defend Battle Position	.7816
Disengage (Dismounted)	.5299
Disengage (Mounted)	.5989
Emplace a Hasty Protective Minefield	.7527
Establish a Hasty Position	.6785
Establish an Objective Rally Point	.7184
Establish a Patrol Base	.7241
Execute Action Right or Left	.6612
Perform a Hasty Dismount	.8540
Knock Out Bunker	.8102
Maintain Noise and Light Discipline	.7703
Maintain Operational Security	.8373
Mount Vehicle	.9026
Move (MOUT)	.8256
Move Dismounted	.5279
Move Mounted	.5557
Occupy an Assembly Area	.7298
Plan and Control Combat Operations	.6302
Platoon Combat Drill	.8329
Prepare a Defensive Position	.8046
Prepare for a Chemical Attack	.8323
Prepare for Combat	.6914
Prepare for a Nuclear Attack	.8436
React to Indirect Fire	.7465
React to Air Attack	.8121
React to an Ambush	.6576
React to a Chemical Attack	.8639
React to Contact	.7124
React to Direct Fire/ATGM	.7522
React to a Nuclear Attack	.7652
Reconnaissance and Security	.8130
Reconnoiter Objective	.6955
Reconnoiter Zone	.6901
Report	.7001
Secure at Halt	.5777
Support by Fire	.6543
Sustain	.7225
Perform Vehicle Operations	.8866

Table D-3

Inter-Rater Agreement Correlation Coefficients
for Light Infantry Platoon Collective Tasks' Performance Estimates

Collective Task Title	Inter-Rater Agreement Correlation Coefficient
Assault	.9151
Breach an Obstacle	.6065
Clear a Building	.7323
Clear Trench Line	.7952
Clear Woodline	.8079
Consolidate and Reorganize	.9055
Construct Obstacles	.7280
Cross a Chemically Contaminated Area	.6720
Cross a Danger Area	.8370
Cross a Radiologically Contaminated Area	.8036
Cross a Water Obstacle	.7009
Defend	.8955
Defend Against Air Attack	.7731
Defend Built-Up Area/Building	.8621
Disengage	.7559
Employ Fire Support	.5883
Infiltrate/Exfiltrate	.6232
Knock Out Bunker	.8450
Maintain Operations Security	.6570
Move Tactically	.9485
Occupy an Assembly Area	.9329
Occupy Observation Post/Perform Surveillance	.7182
Occupy an Objective Rally Point	.5824
Occupy Patrol Base	.9062
Overwatch/Support By Fire	.9323
Perform Aerial Resupply	.8851
Perform an Anti-armor Ambush	.9283
Perform an Area Ambush	.7138
Perform Boat Movement	.7684
Perform a Hasty Ambush	.8741
Perform Helicopter Movement	.8142
Perform Link-Up	.8494
Perform a Passage of Lines	.8250
Perform a Point Ambush	.9011
Perform a Raid	.7012
Perform a Stay-Behind Operation	.8383
Perform a Tactical Road March	.9315
Prepare for Chemical Attack	.6787
Prepare for Combat	.9098
Prepare for Nuclear Attack	.5496
Reconnoiter Area	.7074
Reconnoiter Route	.8678
Reconnoiter Zone	.5582
Screen	.6013
Sustain	.8801

Table D-4

**Inter-Rater Agreement Correlation Coefficients
for Light Infantry Squad Collective Tasks' Performance Estimates**

Collective Task Title	Inter-Rater Agreement Correlation Coefficient
Assault	.9100
Breach an Obstacle	.9354
Clear a Building	.6459
Clear Trench Line	.9164
Clear Woodline	.9063
Consolidate and Reorganize	.8581
Cross a Chemically Contaminated Area	.8538
Cross a Danger Area	.9515
Cross a Radiologically Contaminated Area	.9156
Cross a Water Obstacle	.8889
Defend	.8890
Defend Against Air Attack	.6650
Defend Built-Up Area/Building	.8750
Disengage	.8530
Infiltrate/Exfiltrate	.8670
Knock Out Builder	.9183
Maintain Operations Security	.7163
Move Tactically	.9395
Occupy an Assembly Area	.8623
Occupy Observation Post/Perform Surveillance	.8895
Occupy an Objective Rally Point	.6985
Occupy Patrol Base	.8843
Overwatch/Support By Fire	.9165
Perform Aerial Resupply	.8847
Perform an Anti-armor Ambush	.8959
Perform Boat Movement	.9138
Perform a Hasty Ambush	.8820
Perform Helicopter Movement	.9338
Perform Link-Up	.8546
Perform a Passage of Lines	.8899
Perform a Point Ambush	.9471
Perform a Stay-Behind Operation	.8136
Perform a Tactical Road March	.8830
Prepare for Chemical Attack	.8126
Prepare for Combat	.9175
Prepare for Nuclear Attack	.8925
Reconnoiter Area	.7912
Sustain	.8845

Table D-5

**Inter-Rater Agreement Correlation Coefficients
for Mechanized Infantry Squad Collective Tasks' Performance Estimates**

Collective Task Title	Inter-Rater Agreement Correlation Coefficient
Acquire Targets/Distribute Fire	.4642
Clear a Building	.7195
Conduct Aerial Resupply	.8043
Conduct an Anti-armor Ambush	.6053
Conduct a Hasty Ambush	.5329
Conduct Helicopter Movement	.5154
Conduct a Passage of Lines	.6103
Disengage (Dismounted)	.9061
Establish a Hasty Position	.4849
Establish an Objective Rally Point	.7709
Establish a Patrol Base	.5314
Perform a Hasty Dismount	.9076
Maintain Operational Security	.6388
Mount Vehicle	.6764
Move Dismounted	.7723
Plan and Control Combat Operations	.6899
Prepare for a Chemical Attack	.7898
Prepare for Combat	.6670
Prepare for a Nuclear Attack	.7382
Reach to Indirect Fire	.5919
React to Air Attack	.5446
React to an Ambush	.5881
React to a Chemical Attack	.9187
React to Contact (Dismounted)	.5106
React to Direct Fire/ATGM	.6333
React to a Nuclear Attack	.4996
Reconnaissance and Security	.6454
Reconnoiter Objective	.7063
Sustain	.6693
Perform Vehicle Operations	.5885

APPENDIX E

PROCEDURES FOR RATING UNIT TYPES AND COLLECTIVE TASKS ON FACTORS THAT PREDICT PERFORMANCE CHANGE DUE TO ITI AND TURNOVER

Two sets of procedures are presented in this Appendix. The first set of procedures is for applying the seven factors in the unit type categorization scheme. These procedures begin on page E-2. The second set of procedures is for applying the six factors in the collective task categorization scheme. These procedures begin on page E-5.

INSTRUCTIONS FOR APPLYING UNIT-TYPE CATEGORIZATION FACTORS

Factor 1—Number of Members

Data Source: TOE for the unit type to be evaluated.

Procedure: Count the number of personnel assigned to a full-strength unit, and record the number. Do not include personnel that augment the unit's personnel complement under extraordinary conditions.

Factor 2—Number of Sub-teams in Unit Structure

Data Source: TOE for the unit type to be evaluated, plus doctrinal publications that describe the unit type's organization.

Procedure: Examine the organizational structure of the unit and identify all sub-teams into which the unit is normally organized. Count the entire unit itself as one additional sub-team (sometimes all unit members do the same thing at the same time, such as donning MOPP gear). Hint: every sub-team has a designated leader. Another hint: lower-echelon units within higher-echelon units (*e.g.*, Squads within Platoons) are sub-teams of the higher-echelon unit. They can also have lower-level sub-teams within them (*i.e.*, fire teams within Light Infantry Squads). Record the number of sub-teams in the unit type of interest.

Factor 3—Position Redundancy

Data Source: TOE for the unit type to be evaluated.

Procedure: Identify each unique position title listed in the TOE. Then, count the number of times each position title appears in the unit type, keeping the counts separate for each position title. When counts have been made for all position titles, subtract 1 from the count for each position title. Then, sum the results to give the position redundancy metric. Record the result. Example for a Light Infantry Squad:

<i>Position title</i>	<i>Number of Positions</i>	<i>-1</i>	<i>Equals</i>
Squad Leader	1	-1	0
Fire Team Leader	2	-1	1
Automatic Rifleman	2	-1	1
Grenadier	2	-1	1
Rifleman	2	-1	1
<i>Total (Position Redundancy)</i>			<u>4</u>

Factor 4—Number of Equipment Items per Unit Member (Equipment Density)

Data Source: TOE for the unit type to be evaluated.

Procedure: List all of the major equipment items (vehicles, radios, generator sets, trailers, night vision goggle sets, etc.) and weapons used by the unit type. Include all weapons, including vehicle-mounted weapons, crew-served weapons, and individual weapons. Do not include minor items such as chemical protective clothing, load-carrying equipment, weapons magazines, or hand grenades. Count the number of each equipment type and type of weapon that is assigned to the unit type, per the TOE. Sum the counts over all the equipment and weapons types. Divide this total by the number of personnel assigned to the unit (from Factor 1 above). The result is the equipment density metric. Record it.

Factor 5—Number of Collective Tasks Performed by Unit Type

Data Source: AMTP (and Drill Books, if applicable) for the unit type to be evaluated.

Procedure: Refer to Table 2-2 in Chapter 2 of the AMTP for the unit type, and count each collective task listed. (NOTE: for some kinds of units, tasks for more than one unit type (*i.e.*, Light Infantry Platoon and Squad) may be listed. If this is the case, refer to the T&EOs to identify which tasks are performed by which unit type.)

If there is a Drill Book for the unit type, refer to the Drill Book and count the number of drills included. Add the number of collective tasks counted from the AMTP and the number of drills counted from the Drill Book. This is the total number of collective tasks performed by the unit type. Record this number.

Factor 6—Number of MOS-Unique Individual Tasks Performed by Unit Type

- Data Source:** AMTP for the unit type to be evaluated. Soldier's Manual of Common Tasks, if required.
- Procedure:** Refer to the individual-task to collective-task matrices or listings in Chapter 2 of the applicable AMTP. Eliminate from the matrices or lists any tasks that pertain to equipment that is not used by the unit type being evaluated (*e.g.*, tasks that pertain to M48 and M60 series tanks, in the Armor Platoon AMTP, if an M1 unit type is being evaluated). Also eliminate any common tasks that are included in the listing (see Soldier's Manual of Common Tasks for reference). Count the remaining individual tasks. Record the result.

Factor 7—Number of Leaders in Formal Unit Structure

- Data Source:** TOE for the unit type to be evaluated, supplemented by doctrinal publications for the unit type that describe the unit's organization and responsibilities of individuals holding various positions in the unit.
- Procedure:** Refer to the TOE and other documentation as needed, and identify all positions in the unit type that have primarily leadership responsibility in the unit. Many, but not all, of these positions will have the word "leader" in the position title. Count the number of positions associated with each leadership position title, and sum across all positions. This is the number of leaders. Record the result.

INSTRUCTIONS FOR COLLECTIVE TASK EVALUATION

Your task is to evaluate each (unit type) Task on a set of six factors, and record the results. We have developed a structured recording form for you to use. There is a packet of these forms accompanying these instructions. These instructions tell you what the six task factors are, and give examples of how to record them.

Factor 1--Number of Subtasks and Standards

In the ARTEP MTP (reference given) for (unit type[s]), each collective task is described in terms of the subtasks that are performed in doing the tasks, and the standards that are used to evaluate a unit's performance on the task. We believe that the number of subtasks and standards in a collective task are related to how quickly a team loses proficiency on a task without practice. Your task for this factor is to count and record the number of subtasks (numbered items) in a collective task description, and the number of standards (lettered items) in each standard. You will then total the number of subtasks and standards for the task. Here is an example of a completed worksheet for this factor:

1. Number of subtasks and standards

Number of numbered subtasks in collective task	<u>8</u>
Number of lettered standards in subtask 1	<u>6</u>
Number of lettered standards in subtask 2	<u>4</u>
Number of lettered standards in subtask 3	<u>8</u>
Number of lettered standards in subtask 4	<u>3</u>
Number of lettered standards in subtask 5	<u>2</u>
Number of lettered standards in subtask 6	<u>7</u>
Number of lettered standards in subtask 7	<u>3</u>
Number of lettered standards in subtask 8	<u>9</u>
<i>TOTAL of Subtasks and Standards (Measure)</i>	<u>50</u>

Factor 2--Established/Emergent Rating of Task

Established-emergent is a concept about the amount of variation there can be in performing a collective task. Established tasks are always performed in the same way, regardless of the conditions in which the task is performed. You can think of established tasks as being like very rigid procedures. Emergent tasks are performed differently depending on the conditions in which the task is performed, such as METT-T. Emergent tasks usually have some sequence of steps to them, but the steps are not always performed in the same way. We think that the established-emergent concept influences how rapidly a team loses proficiency in performing a collective task, when the task is not practiced for a period of time. The more emergent a task is, the faster proficiency will be lost without practice.

Your task is to apply a rating scale we have developed to each squad and platoon collective task in (reference). This is a five-point scale; you will assign one of the five numbers in the scale to each task. Choose the rating scale number next to the description that most closely matches your evaluation of a task, and record the number on the recording form. The rating scale is shown in Figure 1, on the following page.

RATING	DESCRIPTION
5	HIGHLY EMERGENT. The procedure or sequence of steps for performing this task cannot be specified in advance at all, without knowing the conditions under which the task takes place. The way the task is performed is very sensitive to changes in the conditions under which it is performed. The way the task is performed can be changed at any time during the task in response to changes in conditions.
4	PRIMARILY EMERGENT. A procedure or sequence of steps for performing some parts of the task can be specified in advance, without knowing the conditions under which the task is performed. Most parts of the task are sensitive to the conditions under which it is performed. The way such parts of the task are performed can be changed in response to changes in conditions.
3	ABOUT EQUALLY ESTABLISHED AND EMERGENT. A procedure or sequence of steps can be specified in advance for about half of the task, without knowing the conditions under which the task is performed. About half of the task is sensitive to the conditions under which it is performed. The way such parts of the task are performed can be changed in response to changes in conditions.
2	PRIMARILY ESTABLISHED. A procedure or sequence of steps can be specified in advance for most parts of the task, without knowing the conditions under which the task is performed. Few parts of the task are sensitive to the conditions under which it is performed. Only minor parts of the task are performed differently when conditions change.
1	HIGHLY ESTABLISHED. A procedure or sequence of steps exists for every part of the task. This procedure is always followed in exactly the same way to accomplish the task. There is no change in the way the task is performed due to changing conditions.

Figure 1. Rating scale for the Established-Emergent dimension.

Factor 3--Average Number of Sub-teams per Subtask

In the ARTEP MTP descriptions of some collective tasks, and in the actual performance of tasks, a unit or team often organizes into *sub-teams* to accomplish parts of a task. For example, in an assault, one fire team from a squad lays down a base of fire to suppress the OPFOR, while the other fire team maneuvers to flank the OPFOR's position and actually assault into the position. We refer to the two fire teams in this example as sub-teams; the squad leader may be a third, separate, sub-team by himself if he only directs the two fire teams in the assault.

Sub-teams don't always correspond to formal organization units such as fire teams within a squad, or squads within a platoon. For example, in crossing a danger area, there may be several sub-teams organized *just for crossing the danger area*--a clearing 'party,' security for the clearing 'party,' rear security, and a command and control element. These sub-teams may or may not correspond to squads, fire teams, or other formal organization elements of the platoon.

Also, the sub-team organization within a unit or team may change during a collective task. The sub-team organization may be different for each subtask, or even change within a subtask.

We think that the sub-team organizations used in a collective task are related to how rapidly a unit's proficiency on the task deteriorates without practicing the task. The more sub-teams that are organized, the faster the deterioration.

Your task for this factor is to compute the *average number of sub-teams* organized within a team *per subtask* of a collective task. You'll do this by a timeline analysis of the collective task description in (reference), supplemented by your knowledge of how the task is actually performed. Following are detailed instructions for the timeline analysis.

(Refer to Figure 2 for a graphic description of the results of this process.)

Using the ARTEP MTP T&EO as an initial outline, develop a sequential timeline of the subtasks performed in conducting the collective task. This timeline need not be keyed to time-based milestones, but it must reflect the sequence of subtasks that are performed in the collective task. (NOTE: Some T&EOs contain alternate subtasks that pertain to units that are equipped differently. Do not use the subtasks for units that are equipped differently from the type of unit under analysis.)

Use this timeline as the horizontal axis of a matrix (in Figure 2, there are four subtasks). Use the MTP T&EO task description and any tactical and doctrinal publications as supplements for the remainder of this analysis. Next, identify each sub-team into which the unit is divided during performance of the collective task of interest. List the sub-teams as separate entries on the vertical axis of the matrix (in Figure 2, there are three sub-teams).

For each sub-team, list the general activity that the sub-team performs during each subtask, in the body of the matrix. Then, examine the activities performed by the sub-teams in each subtask. If necessary, add additional sub-teams or subtasks to the matrix until the matrix is a complete description of the different sub-team activities and subtasks.

Team Type: Light Infantry Squad		Task: Assault			
Sub-teams	Subtasks				
	1	2	3	4	
1. Platoon Leader	Organize, C3	C3, Direct	C3, Direct	C3, Direct	
2. Assault Element	Organize, Prepare	Move to Position	Fire and Movement	Consolidate & Reorganize	
3. Support Element	Organize, Prepare	Suppressive Fire	Lift/Shift Fire	Consolidate & Reorganize	
Total No. Sub-teams Performing Different Activities	2	3	3	2	
	Sum = 2 + 3 + 3 + 2 =		10		
	Total No. Subtasks =		4		
					= Measure (2.5)

Figure 2. Example of computing the number of sub-teams per subtask.

Next, count the number of different activities that are performed by sub-teams in the subtask (in Figure 2, there are two, three, three, and two different sub-team activities involved in the four subtasks). Then, total the number of different sub-team activities across the subtasks (in Figure 2, the total is 10). Divide the total by the number of subtasks, and round to one decimal place (the result in Figure 2 is 2.5). Record this number on the recording form for the collective task.

Factor 4--Number of Individual Tasks

Every collective task calls for individual tasks to be performed during performance of the collective task. Not all collective tasks call for the same individual tasks to be performed, however. We think that the number of different *MOS-specific* individual tasks that are performed in a collective task is related to the rate of change in proficiency when a unit does not practice the collective task. The more individual tasks that are called for, the faster proficiency deteriorates.

Your task for this factor is to determine the number of MOS-specific individual tasks that may be called for in each platoon and squad collective task. To do this, you'll refer to Table (reference) in (reference) the Individual Task-to-Collective Task Matrix. Count and record the number of individual tasks associated with each platoon and squad collective task. DO NOT include common tasks; these are not specific to the (reference) MOS. Also, be sure to include MQS-I and MQS-II tasks in the *platoon* task counts, to make sure that officer tasks are included.

Factor 5--Coactive-Interactive Rating

This is another concept that describes how a unit or team performs a collective task. Coactive-interactive is a dimension of performance that relates to the number of different activities a team performs at one time while performing a collective task, and how team members react to directions or feedback while performing the task.

A coactive task is one where all unit members or sub-teams perform *similar or identical activities simultaneously*, generally under central direction or leadership. Team members tend to adapt their activities in a similar way as a result of directions. An example of a coactive task is an armor platoon preparing for an anticipated nuclear attack by the OPFOR. Certain equipment on each tank is turned off, secured, or otherwise protected. Each member of the platoon dons personal protective equipment. Each crew and each individual performs essentially the same actions in response to an order to make preparation for such an attack.

An interactive task is one where *individual team members or sub-teams perform different activities, often independently*. Communication in interactive tasks tends to be multidirectional, and sub-teams or individual team members may respond to communications or directions in different fashions. A platoon preparing for combat is an example of an interactive task. Each individual team member and leader has responsibilities for checking particular items of equipment and supply, performing inspections, and communicating status information to other team members. Shortfalls in equipment condition or other status items are detected, and instructions for remedying the shortfalls are issued.

We think this dimension is related to the rate at which units lose proficiency on collective tasks without practice. The more a task is interactive, the faster proficiency is lost.

Your task for this factor is to apply a rating scale we have developed for this factor to each collective task. This is a five-point scale; you will assign one of the five numbers in the scale to each task. Choose the rating scale number next to the description that most closely matches your evaluation of a task, and record the number on the recording form. The rating scale is described in Figure 3.

RATING	DESCRIPTION
5	HIGHLY INTERACTIVE. Individual unit members and sub-teams consistently perform different activities and respond in different ways to orders or directions throughout the performance of the task. At no time during task performance are there activities where all team members and sub-teams perform the same activities at the same time.
4	PRIMARILY INTERACTIVE. Individual unit members and sub-teams perform different activities and respond in different ways to orders and directions in most aspects of performing the task. In some minor parts of the task, all team members or sub-teams perform the same activities at the same time.
3	ABOUT EQUALLY INTERACTIVE AND COACTIVE. Individual unit members and sub-teams perform different activities and respond in different ways to orders and directions in about half of the performance of the task. In about half of the task, all team members or sub-teams perform the same activities at the same time.
2	PRIMARILY COACTIVE. Individual unit members and sub-teams perform the same activities at the same time and respond in the same ways to order and directions in most aspects of performing the task. In some minor parts of the tasks, individuals or sub-teams perform activities that are different from those of the remainder of the team.
1	HIGHLY COACTIVE. Individual unit members and sub-teams perform the same activities at the same time and respond to orders or directions in the same ways throughout the performance of the task. At no time during task performance do individuals or sub-teams perform activities that are different from those of other team members.

Figure 3. Rating scale for the Coactive-Interactive dimension.

Factor 6--Potential for Compensation and Correction

If a unit's performance begins to break down while performing a collective task, it's sometimes possible for one unit member to *compensate* for the performance of another. Also, if errors are made in performing a collective task, orders can be given to *correct* the errors. This isn't always possible in all collective tasks; in fact the amount of compensation or correction that is possible varies from one collective task to another. This factor is intended to identify the amount of potential for compensation and correction that is possible *during* collective task performance.

We think this factor is related to the rate of change in collective task proficiency when a task is not practiced for some time, and also to the effects of changes in team membership on collective task performance. We believe that the more that compensation or correction can take place in performing a task, the more performance will deteriorate without practice. On the other hand, we think that tasks where there is more potential for compensation or correction of performance will be less affected by turnover in unit or team membership.

Your task will be to apply a rating scale for the potential for compensation or correction to each collective task, subtask by subtask, and compute an average for the collective task. The average should be computed to one decimal place. We apply the scale this way because we think that the potential for compensation or correction can vary *within* a collective task, as well as across tasks. The scale is shown in Figure 4. An example of applying the scale is shown below. The example shows correction or compensation potential ratings by subtask of 1, 2, 3, 2, 3, 3, 2, and 2. The sum is 18; there are 8 subtasks in the collective task in the example. The average is 2.3

6. Compensation/Correction potential rating

Subtask 1 Rating	<u>1</u>	Subtask 7 Rating	<u>2</u>
Subtask 2 Rating	<u>2</u>	Subtask 8 Rating	<u>2</u>
Subtask 3 Rating	<u>3</u>	Subtask 9 Rating	<u>N/A</u>
Subtask 4 Rating	<u>2</u>	Subtask 10 Rating	<u>N/A</u>
Subtask 5 Rating	<u>3</u>	Subtask 11 Rating	<u>N/A</u>
Subtask 6 Rating	<u>3</u>	Subtask 12 Rating	<u>N/A</u>
Total of all Subtask Ratings	<u>18</u>	/# of Subtasks	<u>8</u> = Measure <u>2.3</u>

RATING	DESCRIPTION
1	HIGH POTENTIAL FOR CORRECTION OR COMPENSATION. There are many opportunities for correcting or compensating for inadequate performance of sub-teams in this subtask. Most or all leaders and sub-teams are aware of the performance of most other sub-teams at any time in this subtask. Other sub-teams can easily provide resources, or leaders can easily direct changes in the activities of the team, to ensure that all sub-teams' activities are successfully accomplished. The team as a whole is at a relatively low level of workload in this subtask.
2	MODERATE POTENTIAL FOR CORRECTION OR COMPENSATION. There are some opportunities for correcting or compensating for inadequate performance of sub-teams in this subtask. At least one other sub-team or leader is aware of the performance of every sub-team at any time in this subtask. Other sub-teams can provide resources at some cost to successfully accomplishing their own activities, or leaders can sometimes direct changes in the activities of the team, to attempt to accomplish all sub-teams' activities successfully. The team as a whole is at a moderate level of workload in this subtask.
3	LOW POTENTIAL FOR CORRECTION OR COMPENSATION. There are few or no opportunities for correcting or compensating for inadequate performance of sub-teams in this subtask. There are times when no leader or other sub-team is aware of the performance of a sub-team in this subtask. Other sub-teams cannot provide resources to an inadequately performing sub-team without causing their own performance to be inadequate. Leaders cannot easily direct changes in the team's activities, to attempt to accomplish all sub-teams' activities successfully. The team as a whole is at a high level of workload in this subtask.

Figure 4. A rating scale for potential for correction and compensation in performing a collective task.

APPENDIX F

RATINGS OF UNIT TYPES AND COLLECTIVE TASKS ON SUSCEPTIBILITY TO PERFORMANCE CHANGE

This Appendix contains 18 tables that present raw data and "High" *versus* "Low" effect declarations due to ITI and turnover for factors that are proposed to predict unit type and collective task sensitivity to performance change, and overall UTEP and CTEP scoring. The first three tables present unit type scoring for eight unit types, as discussed in the body of the report.

These are followed by 15 tables, three for each of five unit types. For each unit type, the first table contains raw scoring data on the six collective task factors. The second table for each unit type contains "High" *versus* "Low" declarations for each of the six factors, for ITI and turnover. Finally, a table containing the CTEP numeric scores is presented.

Table F-1

Unit Type Factors Scoring—Raw Data for Eight Unit Types

Unit Type	Unit-Type Factors						
	Number of Members	Position Redundancy	Number of Subteams	No. Equip. Items per Member	Number of Individual Tasks	Number of Collective Tasks	Number of Leaders
Mechanized Infantry Platoon	37	20	7	3.74	182	58	8
Light Infantry Platoon	34	24	9	1.23	98	62	10
Armor Platoon	16	10	6	3.81	146	65	4
MLRS Firing Platoon	16	7	6	1.94	72	17	5
Mechanized Infantry Squad	9	1	2	3.33	121	28	2
Light Infantry Squad	9	4	3	1.22	38	45	3
Tank Crew	4	0	0	3.75	146	65	1
MLRS Firing Section	3	0	0	1.66	67	14	1

Table F-2

Unit Type Factors Scoring—Effect Declarations for Eight Unit Types

Unit Type	Unit-type Factors						
	Number of Members	Position Redundancy	Number of Subteams	No. Equip. Items per Member	Number of Individual Tasks	Number of Collective Tasks	Number of Leaders
Mechanized Infantry Platoon	High	Low	High	High	High	High	High
Light Infantry Platoon	High	Low	High	Low	Low	High	High
Armor Platoon	High	Low	High	High	High	High	Low
MLRS Firing Platoon	High	High	High	Low	Low	Low	Low
Mechanized Infantry Squad	Low	High	Low	High	High	Low	Low
Light Infantry Squad	Low	High	Low	Low	Low	Low	Low
Tank Crew	Low	High	Low	High	High	High	Low
MLRS Firing Section	Low	High	Low	Low	Low	Low	Low

Table F-3**Unit Type Factors Scoring—UTEP Numeric Scores for Eight Unit Types**

Unit Type	Score for Effect due to ITI	Score for Effect due to Turnover	UTEP Numeric Score
Mechanized Infantry Platoon	6	6	12
Light Infantry Platoon	4	4	8
Armor Platoon	5	5	10
MLRS Firing Platoon	3	2	5
Mechanized Infantry Squad	3	3	6
Light Infantry Squad	1	1	2
Tank Crew	4	4	8
MLRS Firing Section	1	1	2

Table F-4

Collective Task Factors Scoring for Light Infantry Platoon Tasks
Raw Data

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Prepare for Chemical Attack	4	2	1.8	7	2	1
Defend Against Air Attack	8	1	1.5	1	1	2
Cross Nuclear Contaminated Area	8	2	2.0	7	2	1
Maintain Operations Security	5	2	1.4	20	2	1
Prepare for Nuclear Attack	2	2	2.0	7	2	1
Cross Chemically Contaminated Area	5	3	2.0	10	2	1
Overwatch/Support by Fire	7	2	1.4	37	2	1
Reconnoiter Route	4	3	1.0	17	2	1
Perform Helicopter Movement	8	2	3.0	11	2	2
Employ Fire Support	8	2	1.1	10	4	2
Perform Passage of Lines	5	2	2.4	13	2	2
Infiltrate/Exfiltrate	3	4	2.0	12	2	2
Perform Area Ambush	3	4	1.3	29	2	2
Reconnoiter Zone	10	4	0.0	17	2	2
Occupy Objective Rally Point	3	2	2.0	3	3	2
Occupy Observation Post/ Surveillance	5	2	2.0	7	3	2
Perform Boat Movement	9	2	3.0	4	2	2
Conduct Stay-Behind Operation	9	5	1.0	55	2	2
Cross Water Obstacle	14	3	2.1	8	3	1
Clear Buildings	6	3	1.2	15	3	2
Construct Obstacles	6	4	2.0	13	3	2
Breach an Obstacle	12	3	3.4	13	4	2
Occupy Assembly Area	8	2	1.4	51	3	2
Assault	4	3	2.5	26	4	1
Perform Aerial Resupply	7	3	2.4	4	3	1
Perform Link-up	4	3	2.3	9	3	2
Reconnoiter Area	5	3	2.4	17	4	1
Defend a Built-up Area	14	3	1.4	61	3	2
Clear Woodline	6	3	2.2	21	2	2
Perform Anti-Armor Ambush	5	4	2.6	30	4	2
Perform Hasty Ambush	12	4	1.1	18	3	2
Clear Trenchline	11	3	1.5	25	4	2
Occupy Patrol Base	9	3	1.9	20	3	2
Move Tactically	12	3	1.7	23	3	2
Perform Raid	12	4	1.6	29	4	2
Defend	33	4	1.2	61	3	2
Perform Point Ambush	15	4	1.1	28	3	2
Knock Out Bunker	8	4	3.1	20	4	2

Table F-5

**Collective Task Factors Scoring for Light Infantry Platoon Tasks
"High" and "Low" Effect Declarations**

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Prepare for Chemical Attack	Low	Low	Low	Low	Low	Low
Defend Against Air Attack	High	Low	Low	Low	Low	Low
Cross Nuclear Contaminated Area	Low	Low	High	Low	Low	Low
Maintain Operations Security	Low	Low	Low	High	Low	Low
Prepare for Nuclear Attack	Low	Low	High	Low	Low	Low
Cross Chemically Contaminated Area	Low	High	High	Low	Low	Low
Overwatch/Support by Fire	High	Low	Low	High	Low	Low
Reconnoiter Route	Low	High	Low	High	Low	Low
Perform Helicopter Movement	High	Low	High	Low	Low	Low
Employ Fire Support	High	Low	Low	Low	High	Low
Perform Passage of Lines	Low	Low	High	Low	Low	High
Infiltrate/Exfiltrate	Low	High	High	Low	Low	High
Perform Area Ambush	Low	High	Low	High	Low	High
Reconnoiter Zone	High	High	Low	High	Low	Low
Occupy Objective Rally Point	Low	Low	High	Low	High	High
Occupy Observation Post/ Surveillance	Low	Low	High	Low	High	High
Perform Boat Movement	High	Low	High	Low	Low	High
Conduct Stay-Behind Operation	High	High	Low	High	Low	High
Cross Water Obstacle	High	High	High	Low	High	Low
Clear Buildings	High	High	Low	Low	High	High
Construct Obstacles	High	High	High	Low	High	Low
Breach an Obstacle	High	High	High	Low	High	Low
Occupy Assembly Area	High	Low	Low	High	High	High
Assault	Low	High	High	High	High	Low
Perform Aerial Resupply	High	High	High	Low	High	Low
Perform Link-up	Low	High	High	Low	High	High
Reconnoiter Area	Low	High	High	High	High	Low
Defend a Built-up Area	High	High	Low	High	High	High
Clear Woodline	High	High	High	High	Low	High
Perform Anti-Armor Ambush	Low	High	High	High	High	High
Perform Hasty Ambush	High	High	Low	High	High	High
Clear Trenchline	High	High	Low	High	High	High
Occupy Patrol Base	High	High	Low	High	High	High
Move Tactically	High	High	Low	High	High	High
Perform Raid	High	High	Low	High	High	High
Defend	High	High	Low	High	High	High
Perform Point Ambush	High	High	Low	High	High	High
Knock Out Bunker	High	High	High	High	High	High

Table F-6

**Collective Task Factors Scoring for Light Infantry Platoon Tasks
CTEP Numeric Scores**

Task Title	Effect due to ITI	Effect due to Turnover	CTEP Numeric Score
Prepare for Chemical Attack	0	0	0
Defend Against Air Attack	1	1	2
Cross Nuclear Contaminated Area	1	1	2
Maintain Operations Security	1	1	2
Prepare for Nuclear Attack	1	1	2
Cross Chemically Contaminated Area	2	2	4
Overwatch/Support by Fire	2	2	4
Reconnoiter Route	2	2	4
Perform Helicopter Movement	2	2	4
Employ Fire Support	2	2	4
Perform Passage of Lines	2	2	4
Infiltrate/Exfiltrate	3	3	6
Perform Area Ambush	3	3	6
Reconnoiter Zone	3	3	6
Occupy Objective Rally Point	3	3	6
Occupy Observation Post/ Surveillance	3	3	6
Perform Boat Movement	3	3	6
Conduct Stay-Behind Operation	4	4	8
Cross Water Obstacle	4	4	8
Clear Buildings	4	4	8
Construct Obstacles	4	4	8
Breach an Obstacle	4	4	8
Occupy Assembly Area	4	4	8
Assault	4	4	8
Perform Aerial Resupply	4	4	8
Perform Link-up	4	4	8
Reconnoiter Area	4	4	8
Defend a Built-up Area	5	5	10
Clear Woodline	5	5	10
Perform Anti-Armor Ambush	5	5	10
Perform Hasty Ambush	5	5	10
Clear Trenchline	5	5	10
Occupy Patrol Base	5	5	10
Move Tactically	5	5	10
Perform Raid	5	5	10
Defend	5	5	10
Perform Point Ambush	5	5	10
Knock Out Bunker	6	6	12

Table F-7

Collective Task Factors Scoring for Mechanized Infantry Platoon Tasks
Raw Data

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Prepare for a Nuclear Attack	5	1	1.2	19	1	1
Maintain Noise and Light Discipline	2	1	1.0	0	1	1
Maintain Operations Security	3	1	1.0	3	1	1
Plan and Control Combat Operations	10	2	1.2	0	1	1
Perform Helicopter Movement	6	1	1.3	15	1	1
Move Mounted	5	1	1.8	10	2	1
Prepare for Combat	5	1	1.2	64	1	1
Prepare for Chemical Attack	4	1	1.5	17	1	1
Occupy an Assembly Area	5	1	1.2	70	1	1
Conduct a Passage of Lines	5	2	2.1	21	2	1
Secure at Halt	3	1	2.0	10	1	1
Conduct Screen/Guard Operation	5	1	1.4	29	1	1
Reconnaissance and Security	2	1	2.5	0	1	1
Change Formation (Mounted)	3	1	2.3	3	1	1
Conduct Aerial Resupply	7	1	1.3	16	2	1
Move Dismounted	9	2	1.3	14	2	1
React to Indirect Fire	5	3	3.2	8	2	1
Establish a Hasty Position	3	2	3.3	32	2	1
Prepare Defensive Position (Mounted)	14	2	1.2	114	2	1
Consolidate and Reorganize	3	2	2.7	51	2	1
Perform Tactical Road March	7	1	1.3	55	1	1
Sustain	6	1	1.8	0	1	1
Assault (Mounted)	7	2	1.1	36	2	1
Reconnoiter Zone	9	1	1.3	34	1	1
Mount Vehicle	6	2	1.3	32	1	1
Reconnoiter Objective	5	2	1.8	32	2	1
React to a Nuclear Attack	4	2	1.5	26	1	3
Establish Objective Rally Point	3	2	2.3	26	2	2
Cross Defile	4	2	2.5	16	2	2
Support by Fire	6	2	1.7	40	2	1
Perform a Hasty Dismount	8	2	2.1	34	1	1
Establish Patrol Base	9	2	2.0	38	1	1
Emplace Hasty Protective Minefield	7	2	1.1	0	2	3
Execute Action Right or Left	4	2	1.5	15	2	2
Perform Vehicle Operations	12	4	1.1	0	2	3
Clear a Wood Line	6	2	1.8	17	2	2
React to a Chemical Attack	6	2	1.5	22	1	3
React to Contact (Dismounted)	4	5	1.0	28	3	2
Conduct a Hasty Ambush	4	4	2.8	25	3	2
Knock Out Bunker	5	2	2.0	72	3	2
React to Air Attack	6	4	2.2	23	2	3
React to Direct Fire/ATGM	5	4	2.2	37	2	2
Clear a Building	6	3	0.0	43	2	2
Conduct an Anti-Armor Ambush	2	2	6.0	41	4	2
Assault Dismounted (Raid)	9	2	1.9	26	3	2
Conduct Fire and Movement	4	3	2.3	40	3	2
Move (MOUT)	8	3	1.5	24	3	2
Disengage (Mounted)	2	4	3.5	34	3	2
Disengage (Dismounted)	3	5	3.0	35	3	3
Cross a Danger Area (Dismounted)	9	3	1.7	15	3	2
React to Ambush	4	3	2.5	54	3	2
Defend Battle Position	14	3	1.6	105	2	2
Breach an Obstacle	13	4	0.0	35	3	2
Acquire Targets/Distribute Fire	4	3	2.3	34	3	2
Conduct a Point Ambush	7	2	1.9	48	3	2
Platoon Combat Drill	35	4	2.3	84	3	2
Clear a Trenchline	45	3	2.7	38	4	3

Table F-8

Collective Task Factors Scoring for Mechanized Infantry Platoon Tasks
"High" and "Low" Effect Declarations

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Prepare for a Nuclear Attack	Low	Low	Low	Low	Low	Low
Maintain Noise and Light Discipline	Low	Low	Low	Low	Low	Low
Maintain Operations Security	Low	Low	Low	Low	Low	Low
Plan and Control Combat Operations	High	Low	Low	Low	Low	Low
Perform Helicopter Movement	High	Low	Low	Low	Low	Low
Move Mounted	Low	Low	High	Low	Low	Low
Prepare for Combat	Low	Low	Low	High	Low	Low
Prepare for Chemical Attack	Low	Low	High	Low	Low	Low
Occupy an Assembly Area	Low	Low	Low	High	Low	Low
Conduct a Passage of Lines	Low	Low	High	Low	Low	Low
Secure at Halt	Low	Low	High	Low	Low	Low
Conduct Screen/Guard Operation	Low	Low	Low	High	Low	Low
Reconnaissance and Security	Low	Low	High	Low	Low	Low
Change Formation (Mounted)	Low	Low	High	Low	Low	Low
Conduct Aerial Resupply	High	Low	Low	Low	Low	Low
Move Dismounted	High	Low	Low	Low	Low	Low
React to Indirect Fire	Low	High	High	Low	Low	Low
Establish a Hasty Position	Low	Low	High	High	Low	Low
Prepare Defensive Position (Mounted)	High	Low	Low	High	Low	Low
Consolidate and Reorganize	Low	Low	High	High	Low	Low
Perform Tactical Road March	High	Low	Low	High	Low	Low
Sustain	High	Low	High	Low	Low	Low
Assault (Mounted)	High	Low	Low	High	Low	Low
Reconnoiter Zone	High	Low	Low	High	Low	Low
Mount Vehicle	High	Low	Low	High	Low	Low
Reconnoiter Objective	Low	Low	High	High	Low	Low
React to a Nuclear Attack	Low	Low	High	Low	Low	High
Establish Objective Rally Point	Low	Low	High	Low	Low	High
Cross Defile	Low	Low	High	Low	Low	High
Support by Fire	High	Low	High	High	Low	Low
Perform a Hasty Dismount	High	Low	High	High	Low	Low
Establish Patrol Base	High	Low	High	High	Low	Low
Emplace Hasty Protective Minefield	High	Low	High	Low	Low	High
Execute Action Right or Left	Low	Low	High	High	Low	High
Perform Vehicle Operations	High	High	Low	Low	Low	High
Clear a Wood Line	High	Low	High	Low	Low	High
React to a Chemical Attack	High	Low	High	Low	Low	High
React to Contact (Dismounted)	Low	High	Low	Low	High	High
Conduct a Hasty Ambush	Low	High	High	Low	High	High
Knock Out Bunker	Low	Low	High	High	High	High
React to Air Attack	High	High	High	Low	Low	High
React to Direct Fire/ATGM	Low	High	High	High	Low	High
Clear a Building	High	High	Low	High	Low	High
Conduct an Anti-Armor Ambush	Low	Low	High	High	High	High
Assault Dismounted (Raid)	High	Low	High	Low	High	High
Conduct Fire and Movement	Low	High	High	High	High	High
Move (MOUT)	High	High	High	Low	High	High
Dismount (Mounted)	Low	High	High	High	High	High
Dismount (Dismounted)	Low	High	High	High	High	High
Cross a Danger Area (Dismounted)	High	High	High	Low	High	High
React to Ambush	Low	High	High	High	High	High
Defend Battle Position	High	High	High	High	Low	High
Breach an Obstacle	High	High	Low	High	High	High
Acquire Targets/Distribute Fire	Low	High	High	High	High	High
Conduct a Point Ambush	High	Low	High	High	High	High
Platoon Combat Drill	High	High	High	High	High	High
Clear a Trenchline	High	High	High	High	High	High

Table F-9

**Collective Task Factors Scoring for Mechanized Infantry Platoon Tasks
CTEP Numeric Scoring**

Task Title	Effect due to ITI	Effect due to Turnover	CTEP Numeric Score
Prepare for a Nuclear Attack	0	0	0
Maintain Noise and Light Discipline	0	0	0
Maintain Operations Security	0	0	0
Plan and Control Combat Operations	1	1	2
Perform Helicopter Movement	1	1	2
Move Mounted	1	1	2
Prepare for Combat	1	1	2
Prepare for Chemical Attack	1	1	2
Occupy an Assembly Area	1	1	2
Conduct a Passage of Lines	1	1	2
Secure at Halt	1	1	2
Conduct Screen/Guard Operation	1	1	2
Reconnaissance and Security	1	1	2
Change Formation (Mounted)	1	1	2
Conduct Aerial Resupply	1	1	2
Move Dismounted	1	1	2
React to Indirect Fire	2	2	4
Establish a Hasty Position	2	2	4
Prepare Defensive Position (Mounted)	2	2	4
Consolidate and Reorganize	2	2	4
Perform Tactical Road March	2	2	4
Sustain	2	2	4
Assault (Mounted)	2	2	4
Reconnoiter Zone	2	2	4
Mount Vehicle	2	2	4
Reconnoiter Objective	2	2	4
React to a Nuclear Attack	2	2	4
Establish Objective Rally Point	2	2	4
Cross Defile	2	2	4
Support by Fire	3	3	6
Perform a Hasty Dismount	3	3	6
Establish Patrol Base	3	3	6
Erect Hasty Protective Minefield	3	3	6
Execute Action Right or Left	3	3	6
Perform Vehicle Operations	3	3	6
Clear a Wood Line	3	3	6
React to a Chemical Attack	3	3	6
React to Contact (Dismounted)	3	3	6
Conduct a Hasty Ambush	4	4	8
Knock Out Bunker	4	4	8
React to Air Attack	4	4	8
React to Direct Fire/ATGM	4	4	8
Clear a Building	4	4	8
Conduct an Anti-Armor Ambush	4	4	8
Assault Dismounted (Raid)	4	4	8
Conduct Fire and Movement	5	5	10
Move (MOUT)	5	5	10
Disengage (Mounted)	5	5	10
Disengage (Dismounted)	5	5	10
Cross a Danger Area (Dismounted)	5	5	10
React to Ambush	5	5	10
Defend Battle Position	5	5	10
Breach an Obstacle	5	5	10
Acquire Targets/Distribute Fire	5	5	10
Conduct a Point Ambush	5	5	10
Platoon Combat Drill	6	6	12
Clear a Trenchline	6	6	12

Table F-10

Collective Task Factors Scoring for Armor Platoon Tasks
Raw Data

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Process Captured Documents and Equipment	5	1	1.0	0	1	1
Perform Chemical Decontamination	3	1	1.0	0	1	1
Produce a Platoon Fire Plan	4	2	1.0	2	1	1
Execute Herringbone Formation	5	1	1.2	1	1	1
Take Passive Air Defense Measures	2	2	3.0	3	1	1
Conduct a Tactical Road March	5	2	1.4	6	2	1
Execute Staggered Column Formation	3	2	1.7	1	1	1
Employ Camouflage and Countersurveillance	9	2	1.0	2	1	1
Perform Tactical Planning	8	2	1.4	1	1	1
Assist a Passage of Lines	4	4	1.3	2	1	1
Prepare and Evacuate Casualties	5	2	2.5	0	2	1
Execute Wedge Formation	3	2	2.3	1	1	1
Execute Vee Formation	3	2	2.0	1	1	1
Execute Line Formation	3	2	2.3	1	1	1
Execute Traveling Overwatch	7	2	1.3	1	1	1
Execute Traveling	2	2	2.0	1	1	1
Employ Hasty Protective Minefield	8	2	1.0	0	1	1
Execute Column Formation	2	2	2.0	1	1	1
Execute Coil Formation	3	1	1.7	4	1	1
Establish an Observation Post	7	2	1.0	0	1	1
Perform Field Sanitation Operations	4	1	1.5	0	1	1
Battle Drill #1—Change Formation	5	3	1.0	2	2	1
Process Enemy Prisoners of War	8	1	1.1	0	1	1
Prepare for a Nuclear Attack	2	1	3.0	3	1	1
Execute Echelon Formation	3	1	2.3	1	1	1
Occupy a Platoon Battle Position	14	2	1.4	7	2	1
Construct a Hasty Obstacle	6	2	1.0	6	1	1
Respond to Resid. Effects of Nuclear Attack	4	2	1.0	2	1	2
Cross a Nuclear Contaminated Area	4	2	1.3	3	2	2
Rehearse Mission	7	4	1.4	0	1	1
Prepare for Tactical Operations	2	2	1.5	3	3	1
Prepare for Chemical Attack	7	2	1.4	3	1	2
Battle Drill #5—React to Indirect Fire	4	4	1.3	1	2	2
Perform Assembly Area Activities	5	4	1.0	6	3	1
Employ Command and Control Measures	6	4	1.2	6	1	1
Assist a Relief in Place	8	2	1.6	10	1	1
Employ Electronic Counter-countermeasures	5	3	1.0	4	2	2
Perform Resupply Operations	4	2	2.3	4	2	2
Cross a Chemically Contaminated Area	4	2	1.3	6	1	2
Reconnoiter by Fire	5	3	1.8	11	2	1
Conduct a Chemical Reconnaissance	3	4	1.3	6	2	2
Battle Drill #4—Air Attack Drill	3	4	1.3	6	2	2
Execute Bounding Overwatch	4	3	1.3	1	3	2
Prepare for a Friendly Nuclear Strike	2	1	1.5	6	2	2
React to a Chemical Attack	8	2	1.6	3	2	3
Perform a Passage of Lines	6	4	1.3	2	2	2
Battle Drill #3—Contact Drill	3	4	1.0	6	2	2
Perform Precombat Checks	12	3	1.1	26	3	1
Execute a Prepared Obstacle	7	3	1.1	6	2	2
Perform Platoon Fire and Movement	5	5	1.4	10	3	2
Consolidate and Reorganize	4	4	2.8	13	2	2
Respond to Immediate Effects Nuclear Attack	3	3	1.7	19	2	2
Take Actions at an Obstacle	6	4	1.5	3	2	2
Move in a Built-up Area	3	4	1.7	3	3	2
Battle Drill #2—Action Drill	7	4	1.1	7	2	2
Perform Maintenance Operations	5	2	1.6	60	3	2
Assault an Enemy Position	6	5	1.5	9	2	2
Conduct Active Air Defense	5	3	3.8	6	3	3
Perform an Attack by Fire	3	3	2.3	12	3	2
Hasty Occupation of a Battle Position	7	3	1.6	3	3	2
Execute Actions on Contact	6	4	1.2	9	3	3
React to an Enemy Dismounted Attack	11	5	1.5	9	3	3
Execute a Platoon Defensive Mission	12	5	2.1	16	4	2
Displace to a Subsequent Battle Position	9	3	1.9	8	4	2

Table F-11

Collective Task Factors Scoring for Armor Platoon Tasks
"High" and "Low" Effect Declarations

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensation
Process Captured Documents and Equipment	Low	Low	Low	Low	Low	Low
Perform Chemical Decontamination	Low	Low	Low	Low	Low	Low
Produce a Platoon Fire Plan	Low	Low	Low	Low	Low	Low
Execute Herringbone Formation	Low	Low	Low	Low	Low	Low
Take Passive Air Defense Measures	Low	Low	High	Low	Low	Low
Conduct a Tactical Road March	Low	Low	Low	High	Low	Low
Execute Staggered Column Formation	Low	Low	High	Low	Low	Low
Employ Camouflage and Countersurveillance	High	Low	Low	Low	Low	Low
Perform Tactical Planning	High	Low	Low	Low	Low	Low
Assist a Passage of Lines	Low	High	Low	Low	Low	Low
Prepare and Evacuate Casualties	Low	Low	High	Low	Low	Low
Execute Wedge Formation	Low	Low	High	Low	Low	Low
Execute Vee Formation	Low	Low	High	Low	Low	Low
Execute Line Formation	Low	Low	High	Low	Low	Low
Execute Traveling Overwatch	High	Low	Low	Low	Low	Low
Execute Traveling	Low	Low	High	Low	Low	Low
Emplace Hasty Protective Minefield	High	Low	Low	Low	Low	Low
Execute Column Formation	Low	Low	High	Low	Low	Low
Execute Coil Formation	Low	Low	High	Low	Low	Low
Establish an Observation Post	High	Low	Low	Low	Low	Low
Perform Field Sanitation Operations	Low	Low	High	Low	Low	Low
Battle Drill #1—Change Formation	Low	High	Low	Low	Low	Low
Process Enemy Prisoners of War	High	Low	Low	Low	Low	Low
Prepare for a Nuclear Attack	Low	Low	High	Low	Low	Low
Execute Echelon Formation	Low	Low	High	Low	Low	Low
Respond to Residual Effects of Nuclear Attack	Low	Low	Low	Low	Low	High
Cross a Nuclear Contaminated Area	Low	Low	Low	Low	Low	High
Occupy a Platoon Battle Position	High	Low	Low	High	Low	Low
Construct a Hasty Obstacle	High	Low	Low	High	Low	Low
Rehearse Mission	High	High	Low	Low	Low	Low
Prepare for Tactical Operations	Low	Low	High	Low	High	Low
Prepare for Chemical Attack	High	Low	Low	Low	Low	High
Battle Drill #5—React to Indirect Fire	Low	High	Low	Low	Low	High
Employ Electronic Counter-countermeasures	Low	High	Low	Low	Low	High
Perform Resupply Operations	Low	Low	High	Low	Low	High
Cross a Chemically Contaminated Area	Low	Low	Low	High	Low	High
Perform Assembly Area Activities	Low	High	Low	High	High	Low
Employ Command and Control Measures	High	High	Low	High	Low	Low
Assist a Relief in Place	High	Low	High	High	Low	Low
Reconnoiter by Fire	Low	High	High	High	Low	Low
Conduct a Chemical Reconnaissance	High	Low	Low	High	Low	High
Battle Drill #4—Air Attack Drill	Low	High	Low	High	Low	High
Execute Bounding Overwatch	Low	High	Low	Low	High	High
Prepare for a Friendly Nuclear Strike	Low	Low	High	High	Low	High
React to a Chemical Attack	High	Low	High	Low	Low	High
Perform a Passage of Lines	High	High	Low	Low	Low	High
Battle Drill #3—Contact Drill	Low	High	Low	High	Low	High
Perform Precombat Checks	High	High	Low	High	High	Low
Execute a Prepared Obstacle	High	High	Low	High	Low	High
Perform Platoon Fire and Movement	Low	High	Low	High	High	High
Consolidate and Reorganize	Low	High	High	High	Low	High
Respond to Immediate Effects Nuclear Attack	Low	High	High	High	Low	High
Take Actions at an Obstacle	High	High	High	Low	Low	High
Move in a Built-up Area	Low	High	High	Low	High	High
Battle Drill #2—Action Drill	High	High	Low	High	Low	High
Perform Maintenance Operations	Low	Low	High	High	High	High
Assault an Enemy Position	High	High	High	High	Low	High
Conduct Active Air Defense	Low	High	High	High	High	High
Perform an Attack by Fire	Low	High	High	High	High	High
Hasty Occupation of a Battle Position	High	High	High	Low	High	High
Execute Actions on Contact	High	High	Low	High	High	High
React to an Enemy Dismounted Attack	High	High	High	High	High	High
Execute a Platoon Defensive Mission	High	High	High	High	High	High
Displace to a Subsequent Battle Position	High	High	High	High	High	High

Table F-12

Collective Task Factors Scoring for Armor Platoon Tasks
CTEP Numeric Scoring

Task Title	Effect due to ITI	Effect due to Turnover	CTEP Numeric Score
Process Captured Documents and Equipment	0	0	0
Perform Chemical Decontamination	0	0	0
Produce a Platoon Fire Plan	0	0	0
Execute Herringbone Formation	0	0	0
Take Passive Air Defense Measures	1	1	2
Conduct a Tactical Road March	1	1	2
Execute Staggered Column Formation	1	1	2
Employ Camouflage and Countersurveillance	1	1	2
Perform Tactical Planning	1	1	2
Assist a Passage of Lines	1	1	2
Prepare and Evacuate Casualties	1	1	2
Execute Wedge Formation	1	1	2
Execute Vee Formation	1	1	2
Execute Line Formation	1	1	2
Execute Traveling Overwatch	1	1	2
Execute Traveling	1	1	2
Emplace Hasty Protective Minefield	1	1	2
Execute Column Formation	1	1	2
Execute Coil Formation	1	1	2
Establish an Observation Post	1	1	2
Perform Field Sanitation Operations	1	1	2
Battle Drill #1—Change Formation	1	1	2
Process Enemy Prisoners of War	1	1	2
Prepare for a Nuclear Attack	1	1	2
Execute Echelon Formation	1	1	2
Respond to Resid. Effects of Nuclear Attack	1	1	2
Cross a Nuclear Contaminated Area	1	1	2
Occupy a Platoon Battle Position	2	2	4
Construct a Hasty Obstacle	2	2	4
Rehearse Mission	2	2	4
Prepare for Tactical Operations	2	2	4
Prepare for Chemical Attack	2	2	4
Battle Drill #5—React to Indirect Fire	2	2	4
Employ Electronic Counter-countermeasures	2	2	4
Perform Resupply Operations	2	2	4
Cross a Chemically Contaminated Area	2	2	4
Perform Assembly Area Activities	3	3	6
Employ Command and Control Measures	3	3	6
Assist a Relief in Place	3	3	6
Reconnoiter by Fire	3	3	6
Conduct a Chemical Reconnaissance	3	3	6
Battle Drill #4—Air Attack Drill	3	3	6
Execute Bounding Overwatch	3	3	6
Prepare for a Friendly Nuclear Strike	3	3	6
React to a Chemical Attack	3	3	6
Perform a Passage of Lines	3	3	6
Battle Drill #3—Contact Drill	3	3	6
Perform Precombat Checks	4	4	8
Execute a Prepared Obstacle	4	4	8
Perform Platoon Fire and Movement	4	4	8
Consolidate and Reorganize	4	4	8
Respond to Immediate Effects Nuclear Attack	4	4	8
Take Actions at an Obstacle	4	4	8
Move in a Built-up Area	4	4	8
Battle Drill #2—Action Drill	4	4	8
Perform Maintenance Operations	4	4	8
Assault an Enemy Position	5	5	10
Conduct Active Air Defense	5	5	10
Perform an Attack by Fire	5	5	10
Hasty Occupation of a Battle Position	5	5	10
Execute Actions on Contact	5	5	10
React to an Enemy Dismounted Attack	6	6	12
Execute a Platoon Defensive Mission	6	6	12
Displace to a Subsequent Battle Position	6	6	12

Table F-13

Collective Task Factors Scoring for Light Infantry Squad Tasks
Raw Data

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Occupy Objective Rally Point	13	3	3.0	8	2	1.6
Knock Out Bunker	18	2	1.6	39	2	1.1
Perform Tactical Road March	23	2	2.7	24	3	1.5
Defend Against Air Attack	20	2	3.0	7	4	1.6
Infiltrate/Exfiltrate	23	3	6.6	21	2	1.6
Perform Hasty Ambush	27	2	1.9	27	4	1.4
Perform Aerial Resupply	34	2	5.4	11	2	1.5
Cross Water Obstacle	21	3	4.7	22	2	1.7
Clear Wood Line	21	2	2.5	25	3	2.0
Defend	68	2	2.0	91	2	1.6
Assault	23	3	2.7	45	2	1.5
Perform Boat Movement	19	3	3.2	15	3	1.3
Cross Danger Area	27	3	2.2	22	2	1.8
Occupy Assembly Area	21	3	3.1	69	2	1.7
Occupy Obs. Post/Perform Surveillance	19	4	4.2	10	2	1.8
Prepare for Chemical Attack	18	2	3.8	19	4	2.0
Defend Built-up Area/Building	45	2	2.7	87	3	1.3
Sustain	62	2	3.8	12	4	1.8
Cross a Nuclear Contaminated Area	25	3	3.6	13	2	2.0
Perform Point Ambush	36	3	2.0	39	2	1.6
Clear Trenchline	37	3	3.3	38	2	1.8
Move Tactically	57	4	3.7	42	2	1.8
Overwatch/Support by Fire	46	3	2.9	74	2	1.4
Prepare for Nuclear Attack	25	2	4.6	17	4	2.0
Perform Link-up	34	3	5.7	17	2	1.5
Perform Helicopter Movement	34	2	4.1	20	3	1.3
Reconnoiter Area	17	3	4.8	30	2	2.0
Clear a Building	36	4	2.8	34	2	2.0
Breach an Obstacle	54	4	4.6	23	2	2.1
Disengage	57	4	2.3	44	3	1.6
Consolidate and Reorganize	48	2	5.0	46	2	2.0
Occupy Patrol Base	40	3	3.4	32	3	1.6
Perform a Passage of Lines	45	3	3.4	21	4	2.0
Perform Anti-Armor Ambush	30	4	3.8	42	2	1.6
Cross Chemically Contaminated Area	27	3	5.8	15	2	2.0
Perform Stay-Behind Operation	28	4	3.7	69	2	1.8
Prepare for Combat	115	2	4.0	57	4	1.7
Maintain Operations Security	39	2	6.0	56	4	2.0

Table F-14

Collective Task Factors Scoring for Light Infantry Squad Tasks
"High" and "Low" Effect Declarations

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Occupy Objective Rally Point	Low	High	Low	Low	Low	Low
Knock Out Bunker	Low	Low	Low	High	Low	Low
Perform Tactical Road March	Low	Low	Low	Low	High	Low
Defend Against Air Attack	Low	Low	Low	Low	High	Low
Infiltrate/Exfiltrate	Low	High	High	Low	Low	Low
Perform Hasty Ambush	High	Low	Low	Low	High	Low
Perform Aerial Resupply	High	Low	High	Low	Low	Low
Cross Water Obstacle	Low	High	High	Low	Low	Low
Clear Wood Line	Low	Low	Low	Low	High	High
Defend	High	Low	Low	High	Low	Low
Assault	Low	High	Low	High	Low	Low
Perform Boat Movement	Low	High	Low	Low	High	Low
Cross Danger Area	High	High	Low	Low	Low	Low
Occupy Assembly Area	Low	High	Low	High	Low	Low
Occupy Obs. Post/Perform Surveillance	Low	High	High	Low	Low	Low
Prepare for Chemical Attack	Low	Low	High	Low	High	High
Defend Built-up Area/Building	High	Low	Low	High	High	Low
Sustain	High	Low	High	Low	High	Low
Cross a Nuclear Contaminated Area	Low	High	High	Low	Low	High
Perform Point Ambush	High	High	Low	High	Low	Low
Clear Trenchline	High	High	Low	High	Low	Low
Move Tactically	High	High	Low	High	Low	Low
Overwatch/Support by Fire	High	High	Low	High	Low	Low
Prepare for Nuclear Attack	Low	Low	High	Low	High	High
Perform Link-up	High	High	High	Low	Low	Low
Perform Helicopter Movement	High	Low	High	Low	High	Low
Reconnoiter Area	Low	High	High	High	Low	High
Clear a Building	High	High	Low	High	Low	High
Breach an Obstacle	High	High	High	Low	Low	High
Disengage	High	High	Low	High	High	Low
Consolidate and Reorganize	High	Low	High	High	Low	High
Occupy Patrol Base	High	High	Low	High	High	Low
Perform a Passage of Lines	High	High	Low	Low	High	High
Perform Anti-Armor Ambush	High	High	High	High	Low	Low
Cross Chemically Contaminated Area	High	High	High	Low	Low	High
Perform Stay-Behind Operation	High	High	High	High	Low	Low
Prepare for Combat	High	Low	High	High	High	Low
Maintain Operations Security	High	Low	High	High	High	High

Table F-15

**Collective Task Factors Scoring for Light Infantry Squad Tasks
CTEP Numeric Scoring**

Task Title	Effect due to ITI	Effect due to Turnover	CTEP Numeric Score
Occupy Objective Rally Point	1	1	2
Knock Out Bunker	1	1	2
Perform Tactical Road March	1	1	2
Defend Against Air Attack	1	1	2
Infiltrate/Exfiltrate	2	2	4
Perform Hasty Ambush	2	2	4
Perform Aerial Resupply	2	2	4
Cross Water Obstacle	2	2	4
Clear Wood Line	2	2	4
Defend	2	2	4
Assault	2	2	4
Perform Boat Movement	2	2	4
Cross Danger Area	2	2	4
Occupy Assembly Area	2	2	4
Occupy Obs. Post/Perform Surveillance	2	2	4
Prepare for Chemical Attack	3	3	6
Defend Built-up Area/Building	3	3	6
Sustain	3	3	6
Cross a Nuclear Contaminated Area	3	3	6
Perform Point Ambush	3	3	6
Clear Trenchline	3	3	6
Move Tactically	3	3	6
Overwatch/Support by Fire	3	3	6
Prepare for Nuclear Attack	3	3	6
Perform Link-up	3	3	6
Perform Helicopter Movement	3	3	6
Reconnoiter Area	4	4	8
Clear a Building	4	4	8
Breach an Obstacle	4	4	8
Disengage	4	4	8
Consolidate and Reorganize	4	4	8
Occupy Patrol Base	4	4	8
Perform a Passage of Lines	4	4	8
Perform Anti-Armor Ambush	4	4	8
Cross Chemically Contaminated Area	4	4	8
Perform Stay-Behind Operation	4	4	8
Prepare for Combat	4	4	8
Maintain Operations Security	5	5	10

Table F-16

Collective Task Factors Scoring for Mechanized Infantry Squad Tasks
Raw Data

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Prepare for Nuclear Attack	23	2	2.0	2	2	1.0
Prepare for Chemical Attack	17	2	2.0	3	2	1.2
Reconnoiter Objective	17	2	1.4	2	3	1.8
Establish Patrol Base	46	2	1.7	4	2	1.6
Conduct Hasty Ambush	18	4	1.8	5	2	1.7
Move Dismounted	24	2	2.0	2	3	1.4
Plan and Control Combat Operations	41	2	1.7	0	3	1.6
Sustain	34	2	1.3	0	4	1.5
Conduct a Passage of Lines	36	2	1.6	3	4	1.8
React to a Nuclear Attack	20	2	1.4	1	4	2.5
Conduct Helicopter Movement	37	2	2.0	2	4	1.3
Establish Objective Rally Point	15	2	1.7	1	3	2.0
Mount Vehicle	23	1	1.3	11	4	1.1
Maintain Operations Security	21	2	2.0	0	4	2.0
React to Indirect Fire	21	2	2.0	6	3	2.6
Acquire Targets/Distribute Fire	23	3	2.5	13	2	1.7
Establish a Hasty Position	20	2	2.7	5	3	2.0
React to Contact (Dismounted)	15	4	2.0	7	2	2.0
Prepare for Combat	27	2	2.8	26	2	1.2
React to Direct Fire/ATGM	16	3	1.8	20	3	1.9
React to Ambush	22	4	2.0	21	2	2.8
Conduct an Anti-Armor Ambush	17	2	4.0	11	2	2.5
Reconnaissance and Security	22	2	3.0	0	3	2.0
React to Chemical Attack	29	2	1.4	1	4	2.0
Conduct Aerial Resupply	35	2	4.0	4	3	1.5
Disengage (Dismounted)	17	3	2.0	8	3	2.0
Perform Hasty Dismount	31	2	2.3	19	4	1.5
Clear a Building	33	4	3.1	15	2	1.8
React to Air Attack	25	4	1.8	10	3	1.6
Conduct Vehicle Operations	43	3	2.8	0	4	2.0

Table F-17

**Collective Task Factors Scoring for Mechanized Infantry Squad Tasks
"High" and "Low" Effect Declarations**

Task Title	Collective Task Factors					
	Number of Subtasks	Established versus Emergent	Number of Subteams	Number of Individual Tasks	Coactive versus Interactive	Potential for Correction/Compensat.
Prepare for Nuclear Attack	Low	Low	Low	Low	Low	Low
Prepare for Chemical Attack	Low	Low	Low	Low	Low	Low
Reconnoiter Objective	Low	Low	Low	Low	High	Low
Establish Patrol Base	High	Low	Low	Low	Low	Low
Conduct Hasty Ambush	Low	High	Low	Low	Low	Low
Move Dismounted	High	Low	Low	Low	High	Low
Plan and Control Combat Operations	High	Low	Low	Low	High	Low
Sustain	High	Low	Low	Low	High	Low
Conduct a Passage of Lines	High	Low	Low	Low	High	Low
React to a Nuclear Attack	Low	Low	Low	Low	High	High
Conduct Helicopter Movement	High	Low	Low	Low	High	Low
Establish Objective Rally Point	Low	Low	Low	Low	High	High
Mount Vehicle	Low	Low	Low	High	High	Low
Maintain Operations Security	Low	Low	Low	Low	High	High
React to Indirect Fire	Low	Low	Low	High	High	High
Acquire Targets/Distribute Fire	Low	High	High	High	Low	Low
Establish a Hasty Position	Low	Low	High	Low	High	High
React to Contact (Dismounted)	Low	High	Low	High	Low	High
Prepare for Combat	High	Low	High	High	Low	Low
React to Direct Fire/ATGM	Low	High	Low	High	High	Low
React to Ambush	Low	High	Low	High	Low	High
Conduct an Anti-Armor Ambush	Low	Low	High	High	Low	High
Reconnaissance and Security	Low	Low	High	Low	High	High
React to Chemical Attack	High	Low	Low	Low	High	High
Conduct Aerial Resupply	High	Low	High	Low	High	Low
Disengage (Dismounted)	Low	High	Low	High	High	High
Perform Hasty Dismount	High	Low	High	High	High	Low
Clear a Building	High	High	High	High	Low	Low
React to Air Attack	High	High	Low	High	High	Low
Conduct Vehicle Operations	High	High	High	Low	High	High

Table F-18

Collective Task Factors Scoring for Mechanized Infantry Squad Tasks
CTEP Numeric Scoring

Task Title	Effect due to ITI	Effect due to Turnover	CTEP Numeric Score
Prepare for Nuclear Attack	0	0	0
Prepare for Chemical Attack	0	0	0
Reconnoiter Objective	1	1	2
Establish Patrol Base	1	1	2
Conduct Hasty Ambush	1	1	2
Move Dismounted	2	2	4
Plan and Control Combat Operations	2	2	4
Sustain	2	2	4
Conduct a Passage of Lines	2	2	4
React to a Nuclear Attack	2	2	4
Conduct Helicopter Movement	2	2	4
Establish Objective Rally Point	2	2	4
Mount Vehicle	2	2	4
Maintain Operations Security	2	2	4
React to Indirect Fire	3	3	6
Acquire Targets/Distribute Fire	3	3	6
Establish a Hasty Position	3	3	6
React to Contact (Dismounted)	3	3	6
Prepare for Combat	3	3	6
React to Direct Fire/ATGM	3	3	6
React to Ambush	3	3	6
Conduct an Anti-Armor Ambush	3	3	6
Reconnaissance and Security	3	3	6
React to Chemical Attack	3	3	6
Conduct Aerial Resupply	3	3	6
Disengage (Dismounted)	4	4	8
Perform Hasty Dismount	4	4	8
Clear a Building	4	4	8
React to Air Attack	4	4	8
Conduct Vehicle Operations	5	5	10

APPENDIX G

PERFORMANCE PREDICTION EQUATIONS FOR FIVE UNIT TYPES' COLLECTIVE TASKS

This Appendix presents the regression equations derived for predicting task performance for each collective task, for five unit types. These equations are presented in table form. There are seven columns in the tables for each collective task. The first column is the title of the task. The second column is the regression equation constant. The third column is the B weight value for time since training (ITI). In application, this number should be multiplied by an integer that is the number of months since training. The largest valid value for ITI is six months. The fourth through sixth columns are the B weight values for the three turnover predictor variables. In applying these equations, these B weights should be multiplied by a decimal fraction to represent turnover. (E.g., 33 percent turnover in one of the categories would be represented by the number .33.) The final column is the coefficient of multiple regression (Multiple R) associated with the equation.

NOTE 1. The largest allowable values of turnover represented in the SME scenarios are presented below the columns for Non-Leader B Weight, Junior Leader B Weight, and Senior Leader B weight, at the end of each of the five tables. When applying these equations, this number represents the maximum valid total amount of turnover that should be used. This should be thought of as a "not-to-exceed" cumulative value for turnover when applying the equations. For example, if the maximum value shown below a table is .75, the total cumulative turnover (for that personnel category) assumed in the scenario for applying the equation should not exceed 75 percent over the time since training. (E.g., the maximum *average* turnover *RATE* that could be used for six months since training would be *12 percent per month* [75 divided by six and rounded], if the limiting percentage of turnover is 75 percent.) Respecting this restriction will avoid inappropriate extrapolations from these data.

NOTE 2. Not all equations derived contain terms for all four of the performance change predictors. Absent terms are indicated in the tables by the value 9.00000.

Table G-1

Armor Platoon Collective Tasks Regression Equation Weights

Task Title	Regression Equation Constant	ITI B Weight	Senior Leader Turnover B Weight	Junior Leader Turnover B Weight	Non-leader Turnover B Weight	Coefficient of Multiple Regression
Perform Tactical Planning	0.90850	-0.05574	-0.30882	9.00000	9.00000	0.93809
Prepare for Tactical Operations	0.90837	-0.04661	-0.23031	9.00000	-0.11532	0.93525
Perform Precombat Checks	0.93889	-0.04066	-0.39662	9.00000	9.00000	0.97947
Perform Consolidation and Reorganization	0.96134	-0.04104	-0.38227	9.00000	-0.12657	0.99382
Employ ECCM	1.04247	-0.03082	-0.30510	9.00000	-0.11947	0.97466
Produce a Platoon Fire Plan	0.94139	-0.05414	-0.29979	9.00000	-0.11343	0.97185
Employ Command and Control Measures	0.96646	-0.03828	-0.39023	9.00000	-0.10189	0.98544
Perform Assembly Area Activities	0.99400	-0.05133	-0.24107	9.00000	-0.17222	0.98907
Execute a Coil Formation	1.04259	-0.03448	-0.27974	9.00000	-0.15215	0.98131
Execute a Herringbone Formation	1.04129	-0.02596	-0.25654	9.00000	-0.07658	0.98470
Execute a Column Formation	1.02930	-0.02155	-0.20037	9.00000	-0.07655	0.98227
Execute a Staggered Column Formation	1.02200	-0.02140	-0.20878	9.00000	-0.08021	0.98520
Execute a Wedge Formation	1.01713	-0.02155	-0.20270	9.00000	-0.08201	0.98369
Execute a Vee Formation	1.01713	-0.02155	-0.20270	9.00000	-0.08201	0.98369
Execute a Line Formation	1.02361	-0.02182	-0.19740	9.00000	-0.06900	0.98105
Execute a Echelon Formation	1.01716	-0.02235	-0.20024	9.00000	-0.08107	0.98520
Execute Traveling	1.00522	-0.01225	-0.09230	9.00000	-0.05104	0.97897
Execute Traveling Overwatch	0.97263	-0.02908	-0.26969	9.00000	-0.07238	0.96272
Execute Bounding Overwatch	0.97263	-0.02908	-0.26969	9.00000	-0.07238	0.96272
Conduct a Tactical Road March	0.97445	-0.03220	-0.25011	9.00000	-0.11175	0.98291
Move in a Built-Up Area	0.94866	-0.03409	-0.29857	9.00000	-0.06132	0.99050
Assist a Passage of Lines	0.94389	-0.04107	-0.25104	9.00000	-0.09535	0.98893
Perform a Passage of Lines	0.89659	-0.03867	-0.27579	9.00000	-0.05741	0.98858
Conduct Rehearsals for a Mission	0.96768	-0.02291	-0.21588	9.00000	9.00000	0.94165
Perform Platoon Fire and Movement	0.95892	-0.03770	-0.30680	9.00000	-0.05903	0.98294
Perform Reconnaissance By Fire	0.98161	-0.03746	-0.28381	9.00000	-0.05852	0.97415
Perform an Attack By Fire	0.96236	-0.03629	-0.25954	9.00000	-0.06192	0.97103
Assault an Enemy Position	0.93524	-0.03831	-0.24713	9.00000	-0.13195	0.98982
Execute Action on Contact	0.95583	-0.03642	-0.21001	9.00000	-0.18225	0.98708
Occupy a Platoon Battle Position	0.84996	-0.02608	-0.19365	9.00000	-0.09324	0.98986
Displace to a Subsequent Battle Position	0.89070	-0.02571	-0.19519	9.00000	-0.10440	0.99251
React to an Enemy Dismounted Attack	0.97695	-0.02588	-0.23109	9.00000	-0.08739	0.98467
Execute a Platoon Defensive Mission	0.93228	-0.03230	-0.25760	9.00000	-0.13334	0.98730
Assist a Relief in Place	0.93946	-0.03373	-0.24008	9.00000	-0.08497	0.98908
Conduct Hasty Occupation of Battle Pos.	0.98567	-0.02375	-0.20327	9.00000	-0.06368	0.95206
Employ Camo/Countersurveillance Measures	1.00031	-0.02186	-0.09162	9.00000	-0.07151	0.97452
Establish an Observation Post	0.98495	-0.02203	-0.09083	9.00000	-0.07873	0.98300
Process Enemy Prisoners of War	0.98890	-0.02104	-0.05473	9.00000	-0.05750	0.98569
Process Captured Documents and Equipment	0.99652	-0.02036	-0.06483	9.00000	-0.03858	0.97749
Take Action at an Obstacle	0.94408	-0.03780	-0.22813	9.00000	-0.07133	0.98009
Execute a Prepared Obstacle	0.99795	-0.03247	-0.15629	9.00000	-0.10327	0.98957
Construct a Hasty Obstacle	1.00543	-0.02850	-0.19985	9.00000	-0.07926	0.97538
Emplace a Hasty Protective Minefield	0.99797	-0.02935	-0.19245	9.00000	-0.08640	0.97395
Prepare for a Chemical Attack	0.99801	-0.02499	-0.13285	9.00000	-0.10739	0.97116
Prepare for a Nuclear Attack	1.00033	-0.02489	-0.13528	9.00000	-0.10159	0.96920
Prepare for a Friendly Nuclear Strike	1.00112	-0.02496	-0.13626	9.00000	-0.10266	0.96759
Resp. to Initl. Eff. of a Nuclear Attack	0.98901	-0.02264	-0.13229	9.00000	-0.09343	0.97921
Respond to Residual Effects of Nuc. Attack	0.97948	-0.02264	-0.12830	9.00000	-0.09505	0.97619
Cross a Radiologically Contaminated Area	0.97537	-0.02220	-0.12714	9.00000	-0.09802	0.97784
Respond to a Chemical Agent Attack	0.96757	-0.02259	-0.13543	9.00000	-0.09854	0.98128
Conduct a Chemical Reconnaissance	0.94761	-0.03211	-0.21337	9.00000	-0.08085	0.99221
Cross a Chemically Contaminated Area	0.99880	-0.02240	-0.12700	9.00000	-0.08263	0.97492
Perform Chemical Decontamination	1.00967	-0.02676	-0.08240	9.00000	-0.14747	0.96247
Perform Resupply Operations	1.02003	-0.02792	-0.27035	9.00000	-0.05278	0.97608
Prepare and Evacuate Casualties	1.00702	-0.02833	-0.18252	9.00000	-0.06834	0.98466
Perform Maintenance Operations	1.02167	-0.03099	-0.22453	9.00000	-0.12401	0.98078
Perform Field Sanitation Operations	0.97093	-0.01702	-0.13095	9.00000	-0.05197	0.98616
Take Passive Air Defense Measures	0.98196	-0.01419	-0.11083	9.00000	-0.08568	0.98007
Take Active Air Defense Measures	0.93293	-0.03167	-0.13875	9.00000	-0.11500	0.99530
Battle Drill #1 Change Formation	0.97731	-0.01717	-0.21174	9.00000	-0.08089	0.99324
Battle Drill #2 Action Drill	0.96980	-0.02513	-0.23219	9.00000	-0.08160	0.96908
Battle Drill #3 Contact	0.96589	-0.02518	-0.13549	9.00000	-0.07135	0.99658
Battle Drill #4 Air Attack	0.97612	-0.02513	-0.23403	9.00000	-0.08121	0.96977
Battle Drill #5 React to Indirect Fire	0.98122	-0.02540	-0.23317	9.00000	-0.08267	0.96824
MAXIMUM PERCENTAGE OF TURNOVER TO BE USED			100	N/A	75	

Table G-2

Mechanized Infantry Platoon Collective Tasks Regression Equation Weights

Task Title	Regression Equation Constant	ITI B Weight	Senior Leader Turnover B Weight	Junior Leader Turnover B Weight	Non-leader Turnover B Weight	Coefficient of Multiple Regression
Acquire Targets/Distribute Fire	0.56354	-0.04154	-0.13205	-0.09906	-0.10873	0.99561
Assault Dismounted (Raid)	0.91615	-0.05260	-0.31807	-0.11272	9.00000	0.97742
Assault Mounted	0.95179	-0.02635	-0.25068	-0.10586	9.00000	0.96433
Breach Obstacle	0.93835	-0.04283	-0.16583	-0.12515	-0.08688	0.97564
Change Formation(Mounted)	0.97533	-0.02636	-0.19967	-0.05499	9.00000	0.98647
Clear Building	0.92187	-0.05836	-0.18323	-0.08336	-0.06894	0.99496
Clear Trench Line	0.95796	-0.03793	-0.22112	-0.12472	-0.10001	0.98374
Clear Woodline	0.95303	-0.04417	-0.19471	-0.09193	-0.03475	0.99014
Conduct Aerial Resupply	0.94536	-0.02918	-0.24721	-0.17810	9.00000	0.99118
Conduct Antiarmor Ambush	0.93485	-0.02591	-0.20295	-0.10110	9.00000	0.97267
Conduct Fire & Movement	0.90681	-0.05509	-0.34329	-0.13341	9.00000	0.98556
Conduct Hasty Ambush	0.97855	-0.02605	-0.20511	-0.10360	-0.03226	0.97984
Conduct Helicopter Movement	0.97075	-0.03937	-0.33698	-0.09913	-0.08109	0.98645
Conduct Passage of Lines	0.93254	-0.06038	-0.36171	-0.14690	-0.03999	0.99411
Conduct Point Ambush	0.97168	-0.04953	-0.23828	-0.12713	9.00000	0.99815
Conduct Screen/Guard Operations	0.95479	-0.05018	-0.29333	-0.09888	9.00000	0.98494
Conduct Tactical Road March	0.98105	-0.02612	-0.12188	-0.06860	-0.04333	0.98854
Consolidate and Reorganize	0.96823	-0.03390	-0.29944	-0.10977	-0.04847	0.99631
Cross Danger Area (Dismounted)	0.92145	-0.03587	-0.20082	-0.09197	-0.03720	0.98339
Cross Defile	0.95069	-0.04452	-0.20531	-0.08743	-0.03838	0.98924
Defend Battle Position	0.90366	-0.06402	-0.30020	-0.13612	-0.03494	0.99262
Disengage(Dismounted)	0.93397	-0.04962	-0.34207	-0.16832	-0.05930	0.98542
Disengage(Mounted)	0.97347	-0.04249	-0.34956	-0.09058	9.00000	0.97647
Emplace Hasty Protective Minefield	0.93752	-0.03207	-0.27612	-0.09179	9.00000	0.97308
Establish Hasty Position	0.99761	-0.03868	-0.22001	-0.11164	-0.05151	0.97676
Establish Objective Rally	0.96808	-0.02317	-0.27764	-0.07628	9.00000	0.98959
Establish Patrol Base	0.93012	-0.03825	-0.26222	-0.08214	9.00000	0.96989
Execute Action Right or Left	1.00185	-0.03007	-0.13427	-0.06996	-0.03827	0.98956
Hasty Dismount	1.03099	-0.05310	-0.42126	-0.21856	-0.11555	0.98032
Knock Out Bunker	0.92733	-0.02922	-0.25006	-0.14509	9.00000	0.96531
Maintain Noise and Light Discipline	0.94452	-0.04695	-0.16443	-0.08007	-0.13121	0.99628
Maintain Operation Security	0.97828	-0.04549	-0.20306	-0.09077	9.00000	0.99576
Mount Vehicle	1.05076	-0.04906	-0.32131	-0.23251	-0.12492	0.97965
Move (MOUT)	0.91998	-0.05851	-0.33848	-0.12289	-0.04414	0.99078
Move Dismounted	1.01040	-0.05327	-0.19330	-0.10851	-0.05554	0.98449
Move Mounted	0.93855	-0.03056	-0.31085	-0.07067	-0.03973	0.99388
Occupy Assembly Area	0.97669	-0.03308	-0.29460	-0.09380	-0.03017	0.98797
Plan and Control Combat Operations	0.91448	-0.04043	-0.49213	-0.10104	-0.08246	0.98356
Platoon Combat Drill	1.04207	-0.08218	-0.36743	-0.17579	-0.06794	0.99514
Prepare Defensive Position	0.93080	-0.05658	-0.35258	-0.14476	-0.05283	0.99107
Prepare for Chemical Attack	0.98718	-0.03488	-0.16599	-0.05926	-0.03225	0.99472
Prepare for Combat	0.98219	-0.03202	-0.34691	-0.13982	9.00000	0.97958
Prepare for Nuclear Attack	0.95634	-0.03151	-0.17352	-0.07122	-0.03141	0.99688
Reach to Indirect Fire	0.97489	-0.02578	-0.09161	-0.06423	-0.12451	0.97759
React to Air Attack	0.99269	-0.03099	-0.11138	-0.08444	-0.08958	0.97901
React to Ambush	0.91086	-0.04110	-0.27662	-0.18043	9.00000	0.96249
React to Chemical Attack	0.94442	-0.02795	-0.26587	-0.07415	-0.02763	0.98495
React to Contact	0.98318	-0.04535	-0.37081	-0.13497	9.00000	0.98798
React to Direct Fire/ATGM	0.94979	-0.03340	-0.32261	-0.12118	9.00000	0.94343
React to Nuclear Attack	0.95664	-0.02867	-0.24699	-0.06865	9.00000	0.98395
Reconnaissance and Security	0.92766	-0.04519	-0.28748	-0.09831	9.00000	0.99413
Reconnoiter Objective	0.96351	-0.04419	-0.23363	-0.07407	9.00000	0.98007
Reconnoiter Zone	0.92534	-0.05198	-0.25308	-0.09366	9.00000	0.98619
Report	0.94809	-0.04013	-0.18805	-0.07592	9.00000	0.99270
Secure at Halt	0.97642	-0.03127	-0.15666	-0.09572	-0.05347	0.99406
Support by Fire	0.98379	-0.04756	-0.27565	-0.14527	9.00000	0.96996
Sustain	0.94597	-0.03549	-0.27746	-0.09360	-0.08730	0.99769
Vehicle Operations	0.96108	-0.03227	-0.08651	-0.07857	-0.11735	0.98823
MAXIMUM PERCENTAGE OF TURNOVER TO BE USED			33	83	56	

Table G-3

Light Infantry Platoon Collective Tasks Regression Equation Weights

Task Title	Regression		Senior Leader	Junior Leader	Non-leader	Coefficient of
	Equation	ITI B	Turnover	Turnover	Turnover	Multiple
	Constant	Weight	B Weight	B Weight	B Weight	Regression
Assault	1.03836	-0.02422	-0.04926	-0.12015	9.00000	0.97004
Breach Obstacle	1.02159	-0.01351	-0.05300	-0.10663	-0.04472	0.97611
Clear Building	1.03975	-0.01858	-0.03503	-0.13565	-0.07581	0.97899
Clear Trench Line	1.04791	-0.03867	9.00000	-0.06786	-0.12042	0.97034
Clear Woodline	1.04858	-0.02253	-0.03690	-0.09809	-0.09025	0.97339
Consolidate and Reorganize	1.02814	-0.02476	-0.01878	-0.07610	9.00000	0.96532
Construct Obstacles	1.01915	-0.01555	-0.03362	-0.11212	-0.03061	0.97270
Cross Chemically Contaminated Area	1.03454	-0.01612	-0.02809	-0.08895	-0.03410	0.97005
Cross Danger Area	1.05986	-0.02336	-0.04757	-0.12898	-0.09300	0.97451
Cross Nuclear Contaminated Area	1.02980	-0.01772	-0.01036	-0.05447	-0.02866	0.97604
Cross Water Obstacle	1.03292	-0.01412	-0.05087	-0.12460	-0.03550	0.96603
Defend	1.06196	-0.03495	-0.05013	-0.09033	-0.05592	0.98184
Defend Against Air Attack	1.02367	-0.01202	-0.03403	-0.08475	9.00000	0.95430
Defend Built-Up Area/Building	1.04501	-0.02683	-0.02801	-0.10646	-0.03091	0.98222
Disengage	1.05964	-0.04430	-0.06865	-0.12551	-0.09198	0.96673
Employ Fire Support	1.02189	-0.01542	-0.03395	-0.08704	-0.06161	0.97672
Infiltrate/Exfiltrate	1.03331	-0.01730	-0.01718	-0.11765	-0.08979	0.97270
Knock Out Bunker	1.05833	-0.04087	-0.08772	-0.09896	-0.08398	0.95210
Maintain Operations Security	1.03226	-0.01911	-0.02065	-0.12017	-0.03091	0.98992
Move Tactically	1.06470	-0.02943	-0.08004	-0.11059	-0.05322	0.97371
Occupy Assembly Area	1.06339	-0.03366	9.00000	-0.08724	-0.08243	0.95894
Occupy OP/Perform Surveillance	1.02903	-0.01205	-0.02203	-0.06225	-0.02827	0.95513
Occupy Objective Rally Point	1.02970	-0.01546	-0.08594	-0.11288	9.00000	0.96157
Occupy Patrol Base	1.04795	-0.02480	-0.03959	-0.07627	-0.03964	0.97709
Overwatch/Support By Fire	1.05538	-0.02638	-0.05987	-0.10248	-0.02856	0.97907
Perform Aerial Resupply	1.03423	-0.02003	-0.03079	-0.07631	9.00000	0.94461
Perform Antiarmor Ambush	1.05433	-0.03464	-0.07248	-0.10617	-0.04536	0.96227
Perform Area Ambush	1.05235	-0.02480	-0.02608	-0.06017	-0.12233	0.96563
Perform Boat Movement	1.02530	-0.01507	-0.05690	-0.10044	9.00000	0.96324
Perform Hasty Ambush	1.06780	-0.03056	-0.09268	-0.11540	-0.08002	0.96999
Perform Helicopter Movement	1.03010	-0.01434	-0.03778	-0.09001	9.00000	0.96126
Perform Link-Up	1.04497	-0.01831	9.00000	-0.07037	-0.06552	0.95165
Perform Passage of Lines	1.03662	-0.02184	-0.02769	-0.07462	-0.02869	0.97236
Perform Point Ambush	1.07101	-0.03284	-0.06830	-0.11113	-0.05449	0.96229
Perform Raid	1.05732	-0.03700	-0.08689	-0.07310	-0.11819	0.95621
Perform Stay-Behind Operation	1.03783	-0.02098	-0.01833	-0.14253	-0.07225	0.98300
Perform Tactical Road March	1.04879	-0.02142	-0.04143	-0.07521	-0.05564	0.97871
Prepare for Chemical Attack	1.02425	-0.01170	-0.01916	-0.06166	9.00000	0.94390
Prepare for Combat	1.02799	-0.02153	-0.02540	-0.08733	9.00000	0.95241
Prepare for Nuclear Attack	1.01663	-0.01850	9.00000	-0.08613	9.00000	0.59290
Reconnoiter Area	1.02242	-0.01127	-0.08215	-0.11261	9.00000	0.95808
Reconnoiter Route	1.03896	-0.01652	-0.05319	-0.13179	-0.02900	0.97670
Reconnoiter Zone	1.02035	-0.01245	-0.07654	-0.10043	9.00000	0.96646
Screen	1.03268	-0.01683	-0.03190	-0.10711	-0.09503	0.97557
Sustain	1.03581	-0.02108	-0.03736	-0.09363	9.00000	0.96286
MAXIMUM PERCENTAGE OF TURNOVER TO BE USED			50	56	57	

Table G-4

Light Infantry Squad Collective Tasks Regression Equation Weights

Task Title	Regression Equation		Senior Leader	Junior Leader	Non-leader	Coefficient of Multiple Regression
	Constant	ITI B Weight	Turnover B Weight	Turnover B Weight	Turnover B Weight	
Assault	1.04961	-0.02504	-0.04679	9.00000	-0.15794	0.93735
Breach Obstacle	1.03373	-0.02048	-0.06002	-0.09272	-0.11062	0.98918
Clear Building	1.01669	-0.02056	-0.04742	-0.06102	-0.12047	0.98658
Clear Trench Line	1.05015	-0.02693	-0.05295	-0.06870	-0.14865	0.99082
Clear Woodline	1.05609	-0.02099	-0.04035	-0.01120	-0.15849	0.96536
Consolidate and Reorganize	1.01963	-0.00804	-0.05825	-0.09050	9.00000	0.94274
Cross Chemically Contaminated Area	1.03235	-0.01695	-0.03604	-0.09314	-0.05964	0.98933
Cross Danger Area	1.04772	-0.02022	-0.04344	-0.08750	-0.10270	0.98153
Cross Nuclear Contaminated Area	1.04355	-0.01857	-0.05361	-0.10654	-0.07350	0.98049
Cross Water Obstacle	1.04082	-0.01496	-0.06262	-0.07229	-0.07014	0.97162
Defend	1.03847	-0.02818	-0.05689	-0.03547	-0.12292	0.97725
Defend Against Air Attack	1.00783	-0.00613	9.00000	-0.02917	9.00000	0.81899
Defend Built-Up Area/Building	1.04198	-0.02288	-0.04336	-0.03404	-0.12279	0.96765
Disengage	1.05095	-0.02700	9.00000	-0.04654	-0.15908	0.97650
Infiltrate/Exfiltrate	1.03268	-0.01688	-0.06111	-0.12154	-0.09134	0.98674
Knock Out Bunker	1.05369	-0.02542	-0.03991	-0.06769	-0.14426	0.98206
Maintain Operations Security	1.02220	-0.01371	9.00000	-0.04080	-0.04901	0.92115
Move Tactically	1.04586	-0.02552	-0.05555	-0.08613	-0.07754	0.97745
Occupy Assembly Area	1.03548	-0.01581	-0.03861	9.00000	-0.10820	0.88878
Occupy OP/Perform Surveillance	1.02821	-0.01615	-0.05648	-0.08626	-0.09261	0.98838
Occupy Objective Rally Point	1.03742	-0.01535	-0.03873	-0.08609	-0.06880	0.98093
Occupy Patrol Base	1.02835	-0.01417	-0.03445	-0.02221	-0.07720	0.95859
Overwatch/Support By Fire	1.06683	-0.02845	-0.05912	-0.07305	-0.15601	0.96887
Perform Aerial Resupply	1.02830	-0.01371	-0.06032	-0.08357	-0.05551	0.98090
Perform Antiarmor Ambush	1.04739	-0.02504	-0.05971	-0.06081	-0.13253	0.98319
Perform Boat Movement	1.02279	-0.01109	-0.04975	-0.04900	9.00000	0.93707
Perform Hasty Ambush	1.04935	-0.02511	-0.06441	-0.06890	-0.13659	0.99152
Perform Helicopter Movement	1.04012	-0.01450	-0.02786	-0.11140	-0.07859	0.97567
Perform Link-Up	1.03650	-0.01685	-0.01901	-0.02135	-0.05870	0.96614
Perform Passage of Lines	1.03676	-0.01400	9.00000	-0.03301	-0.08041	0.94450
Perform Point Ambush	1.04517	-0.02581	-0.07679	-0.06935	-0.12344	0.99198
Perform Stay-Behind Operation	1.01325	-0.02019	-0.03268	-0.08677	-0.11711	0.99081
Perform Tactical Road March	1.03721	-0.01869	9.00000	-0.10208	9.00000	0.95947
Prepare for Chemical Attack	1.02680	-0.01136	-0.04242	-0.08328	-0.02778	0.96581
Prepare for Combat	1.02473	-0.01230	-0.03575	-0.08300	9.00000	0.95638
Prepare for Nuclear Attack	1.03399	-0.01775	-0.04500	-0.12107	-0.06889	0.98630
Reconnoiter Area	1.04304	-0.01552	-0.06292	-0.08920	-0.08393	0.97746
Sustain	1.05520	-0.02722	-0.06006	-0.01781	-0.14818	0.98664
MAXIMUM PERCENTAGE OF TURNOVER TO BE USED			100	100	63	

Table G-5

Mechanized Infantry Squad Collective Tasks Regression Equation Weights

Task Title	Regression Equation		Senior Leader Turnover B Weight	Junior Leader Turnover B Weight	Non-leader Turnover B Weight	Coefficient of Multiple Regression
	Constant	ITI B Weight				
Acquire Targets/Distribute Fire	0.94045	-0.04092	-0.04203	-0.09877	-0.03988	0.99570
Clear Building	0.88696	-0.03329	-0.04941	-0.05062	-0.05628	0.98537
Conduct Aerial Resupply	0.95009	-0.01952	-0.04500	-0.04542	9.00000	0.96512
Conduct Antiarmor Ambush	0.94871	-0.02935	-0.06250	-0.04208	9.00000	0.97311
Conduct Hasty Ambush	0.98560	-0.03252	-0.06701	-0.03005	-0.03973	0.98568
Conduct Helicopter Movement	0.97869	-0.02421	-0.07000	-0.06000	9.00000	0.97864
Conduct Passage of Lines	0.92703	-0.03421	-0.08500	-0.02208	9.00000	0.99140
Disengage (Dismounted)	0.90748	-0.04295	-0.05801	-0.03606	-0.08113	0.99078
Establish Hasty Position	0.98428	-0.03017	-0.12069	-0.08189	-0.07369	0.99571
Establish Objective Rally Point	0.97288	-0.02500	-0.04000	-0.03792	9.00000	0.98914
Establish Patrol Base	0.92754	-0.03366	-0.09112	-0.03467	-0.05946	0.99524
Hasty Dismount	0.97963	-0.02092	-0.03780	-0.03418	-0.06242	0.98363
Maintain Operation Security	0.93925	-0.02562	-0.05518	-0.07575	-0.05297	0.99239
Mount Vehicle	0.99205	-0.01676	-0.07177	-0.01995	-0.05529	0.98606
Move Dismounted	0.85797	-0.04339	-0.04915	-0.06653	-0.04585	0.98808
Plan and Control Combat Operations	0.93159	-0.03690	-0.05250	-0.02167	9.00000	0.99430
Prepare for Chemical Attack	0.94741	-0.02458	-0.03122	-0.03748	-0.06010	0.99516
Prepare for Combat	0.96253	-0.02216	-0.06050	-0.03474	-0.04658	0.98481
Prepare for Nuclear Attack	0.92832	-0.27580	-0.04333	-0.02441	-0.06605	0.99558
React to Air Attack	0.97559	-0.02441	-0.04418	-0.03187	-0.02880	0.98233
React to Ambush	0.88602	-0.03521	-0.05005	-0.07545	-0.03482	0.98167
React to Chemical Attack	0.83080	-0.02433	-0.04222	-0.02165	-0.11013	0.98907
React to Contact (Dismounted)	0.94882	-0.02441	-0.06348	-0.02275	-0.05849	0.99602
React to Direct Fire/ATGM	0.96279	-0.02513	-0.04146	-0.03820	-0.03583	0.98368
React to Indirect Fire	0.97205	-0.02121	-0.03603	-0.02844	-0.02434	0.98585
React to Nuclear Attack	0.93800	-0.02714	-0.03066	-0.03387	-0.02176	0.99252
Reconnaissance and Security	0.92295	-0.02852	-0.06615	-0.06988	-0.06825	0.97851
Reconnoiter Objective	0.92444	-0.02726	-0.03875	-0.03958	9.00000	0.98495
Sustain	0.92280	-0.03400	-0.04737	-0.07259	-0.05944	0.98828
Vehicle Operations	0.94682	-0.03022	-0.06197	-0.03319	-0.03085	0.98133
MAXIMUM PERCENTAGE OF TURNOVER TO BE USED			100	100	71	

APPENDIX H

PLOTS OF PREDICTED PROFICIENCY OF COLLECTIVE TASK PERFORMANCE UNDER A COMMON SCENARIO

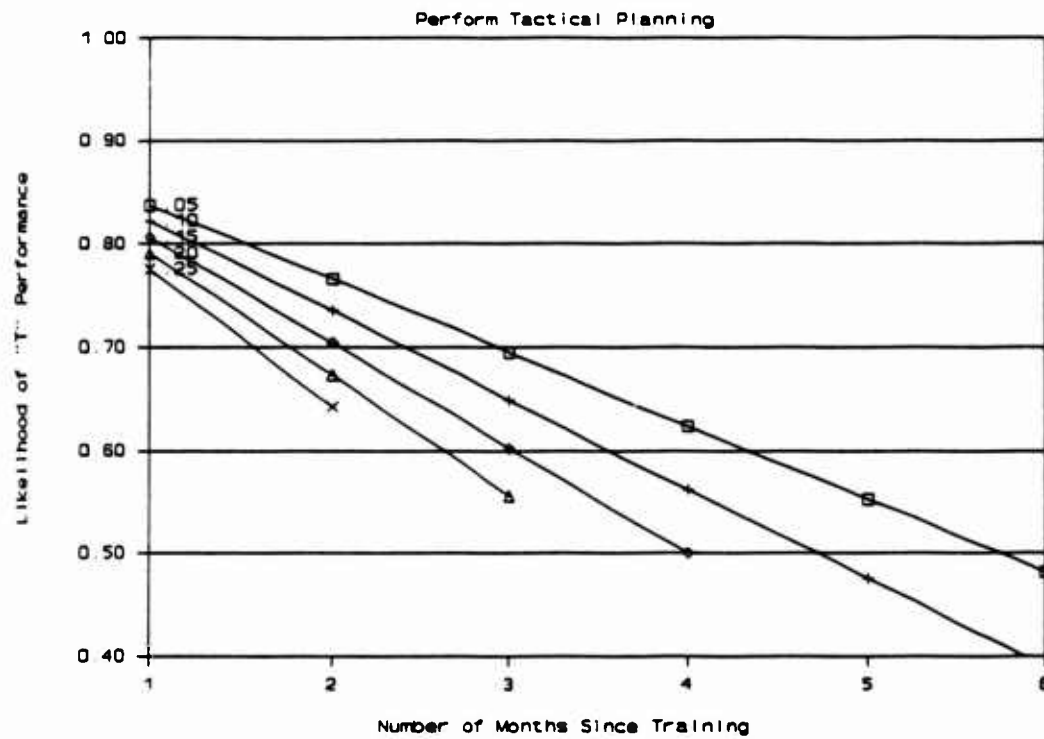
This Appendix contains plots for all 235 collective tasks for which SME performance estimates were made in the research. These plots are all based on a common set of assumptions, so that a visual comparison of predicted performance change can be made, task-by-task. In each plot, five different rates of turnover have been used to compute the points plotted—5, 10, 15, 20, and 25 percent per month. This turnover is assumed to be common across all categories of personnel in a unit type (senior leaders, junior leaders, and non-leaders). That is, the line in a plot noted as a five percent level of turnover is based on the assumption that the level of membership change in each personnel category, *in each month* of the indicated period without training, is five percent. The time intervals without training are 1 to 6 months.

Note that some of the plots extend to less than six months without training. This is to avoid extrapolating beyond the levels of turnover that were used in the SME estimation scenarios.

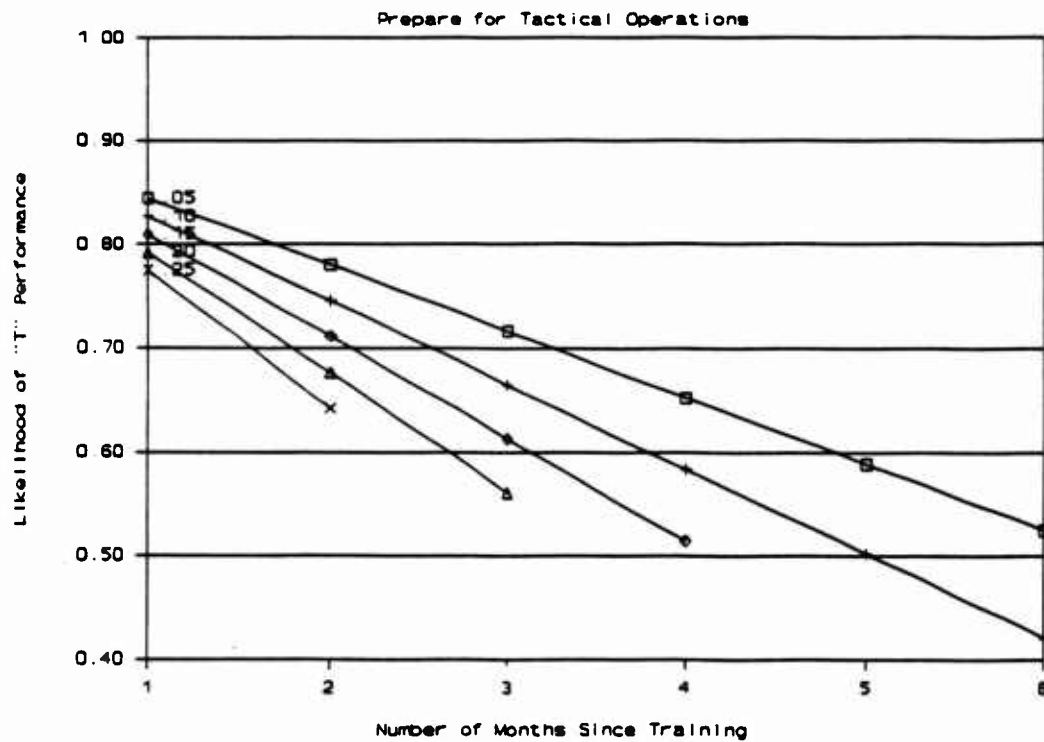
The plots for tasks associated with each unit type begin on the following pages:

- Armor Platoon task plots begin on page H-2.
- Mechanized Infantry Platoon task plots begin on page H-34.
- Light Infantry Platoon task plots begin on page H-63.
- Light Infantry Squad task plots begin on page H-86.
- Mechanized Infantry Squad task plots begin on page H-105.

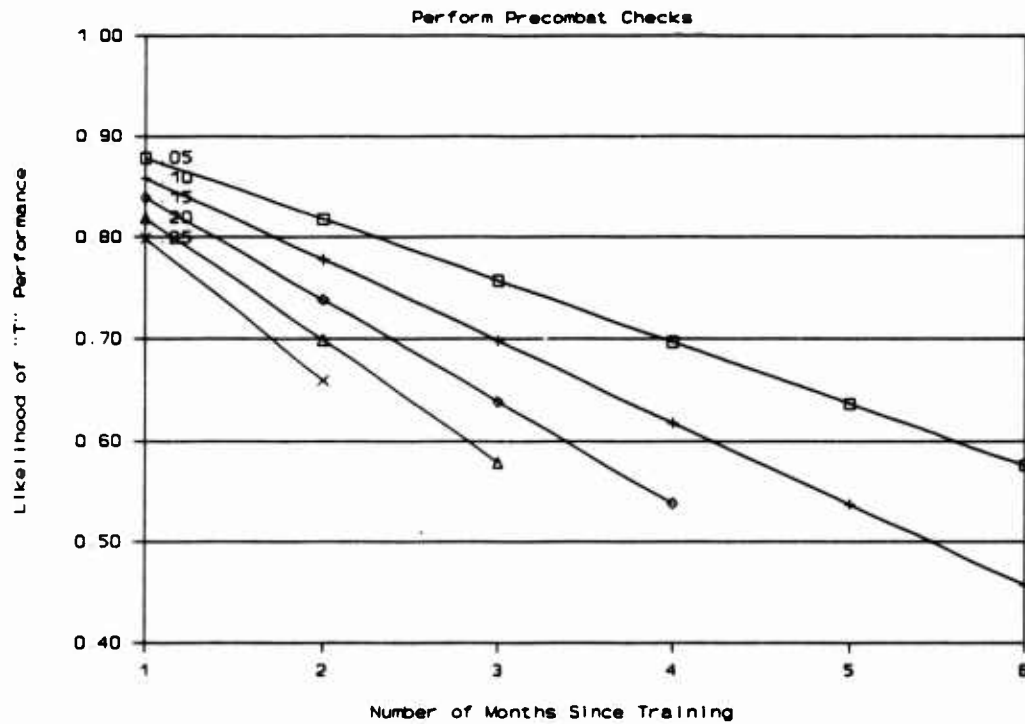
Armor Platoon Task



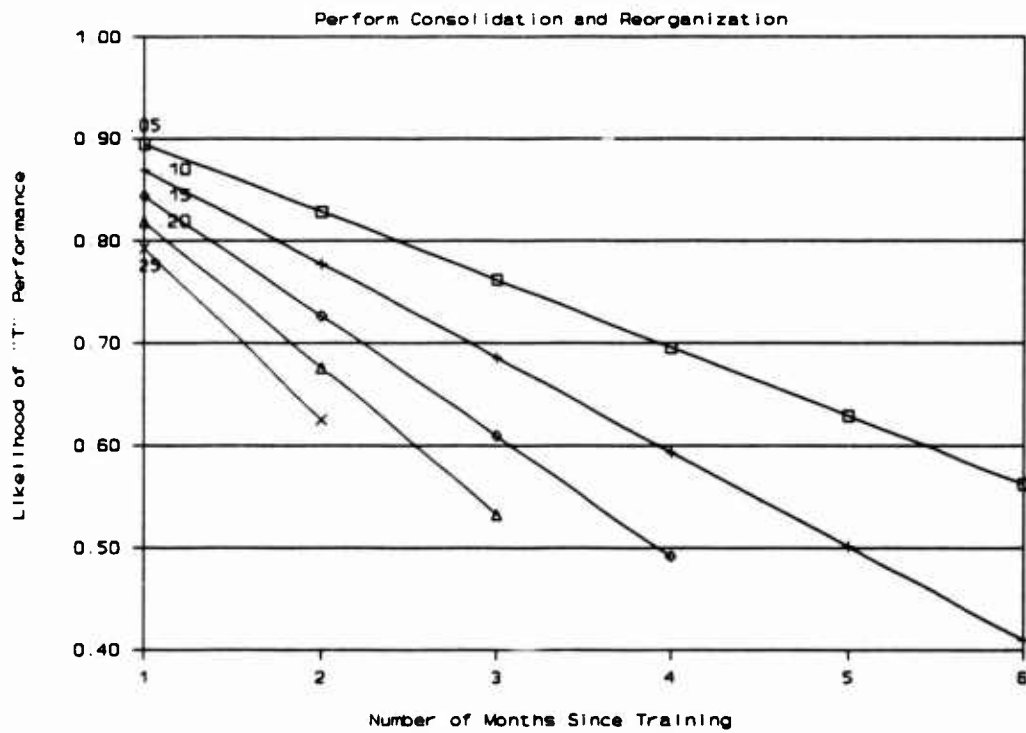
Armor Platoon Task



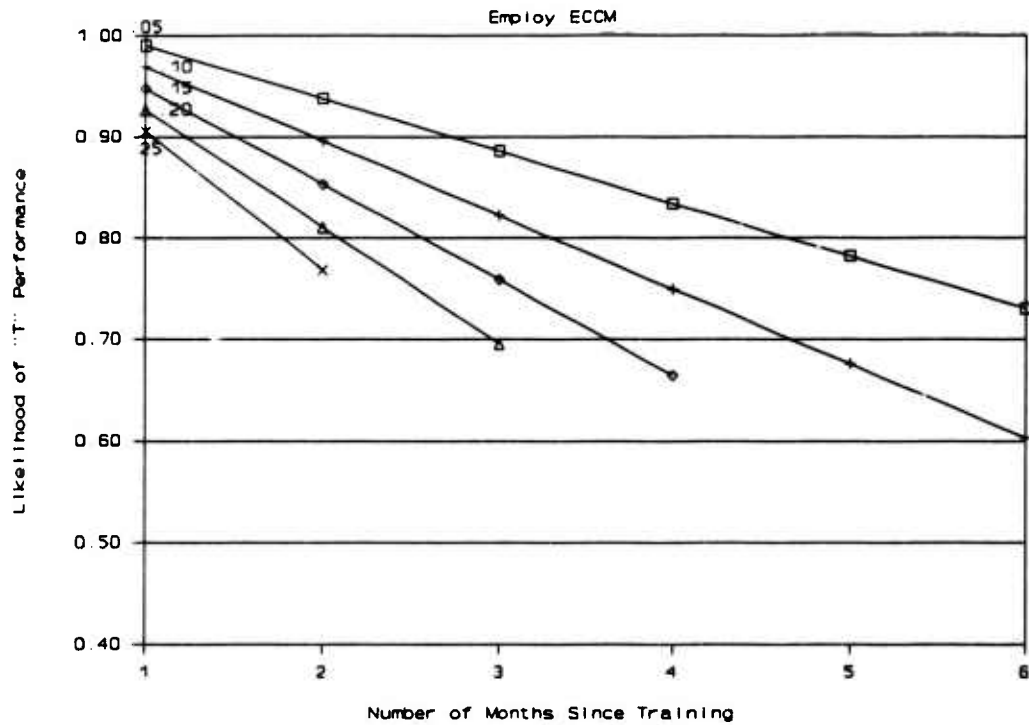
Armor Platoon Task



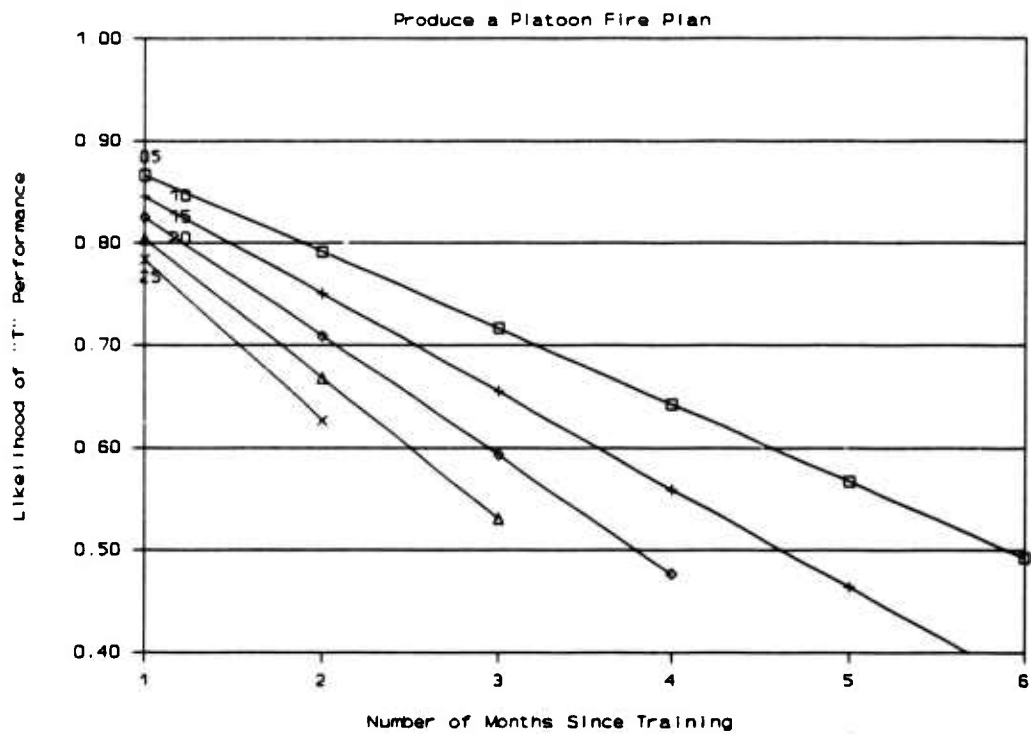
Armor Platoon Task



Armor Platoon Task

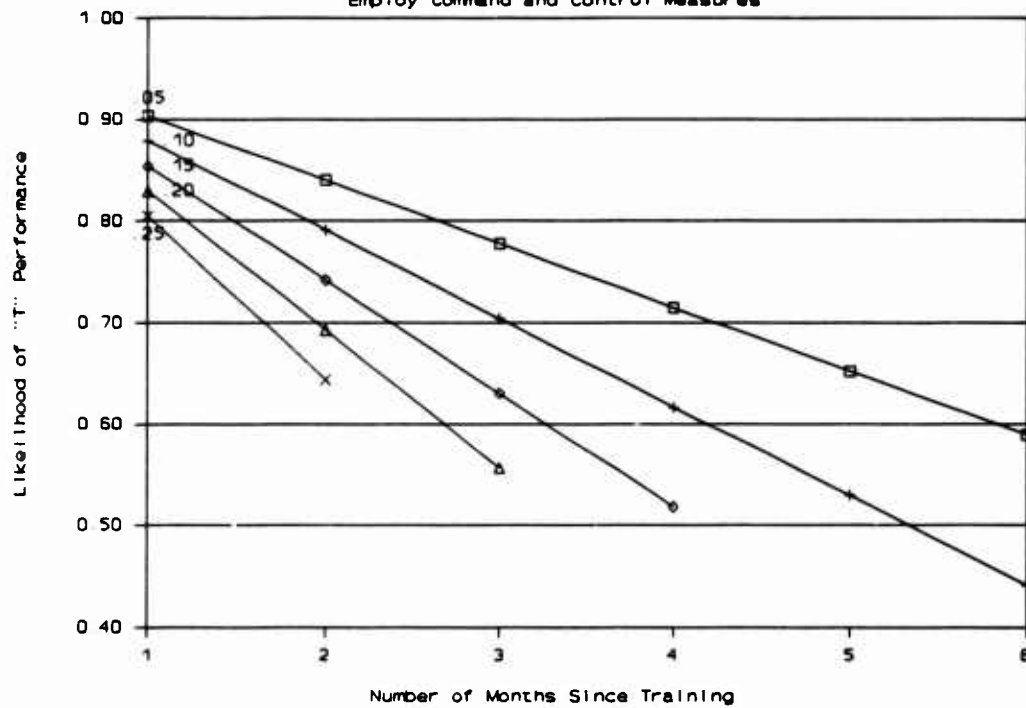


Armor Platoon Task



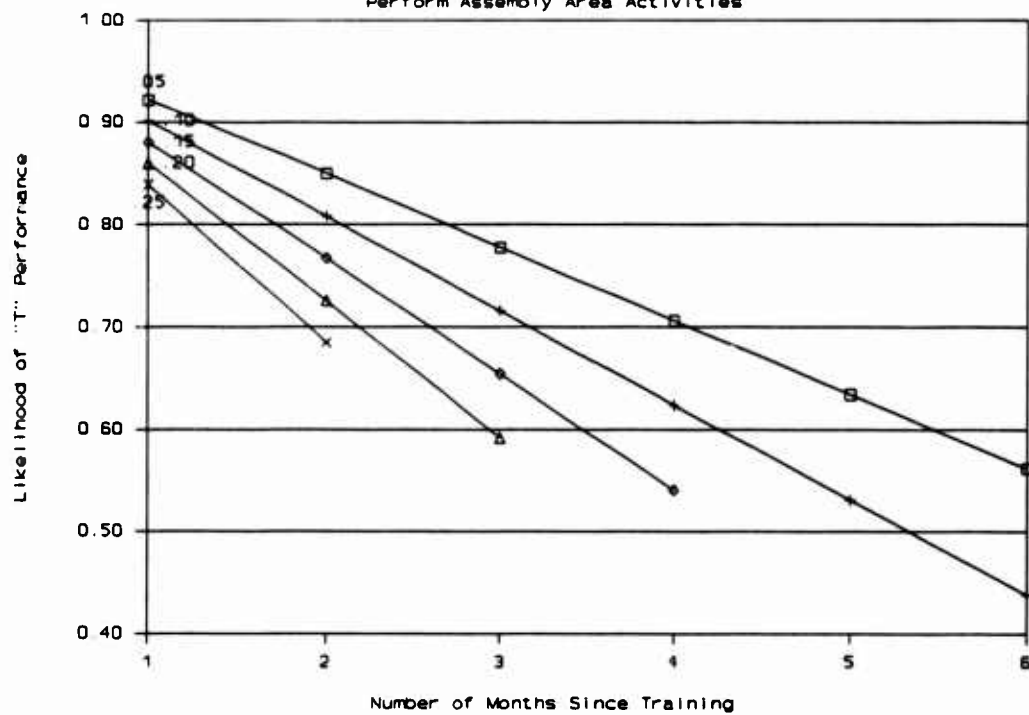
Armor Platoon Task

Employ Command and Control Measures

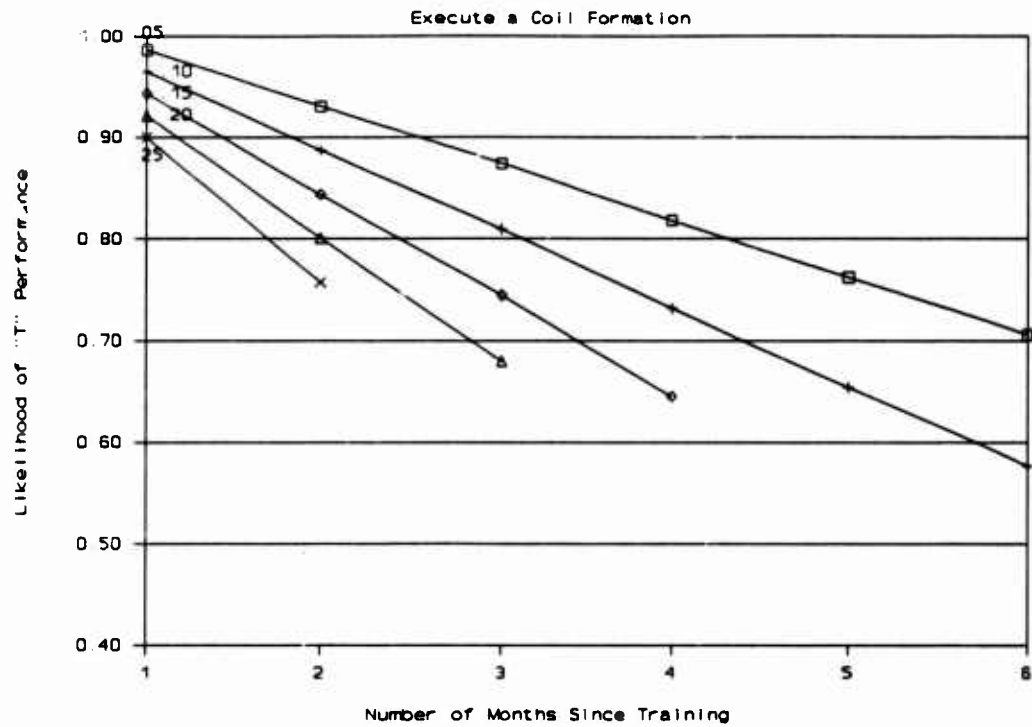


Armor Platoon Task

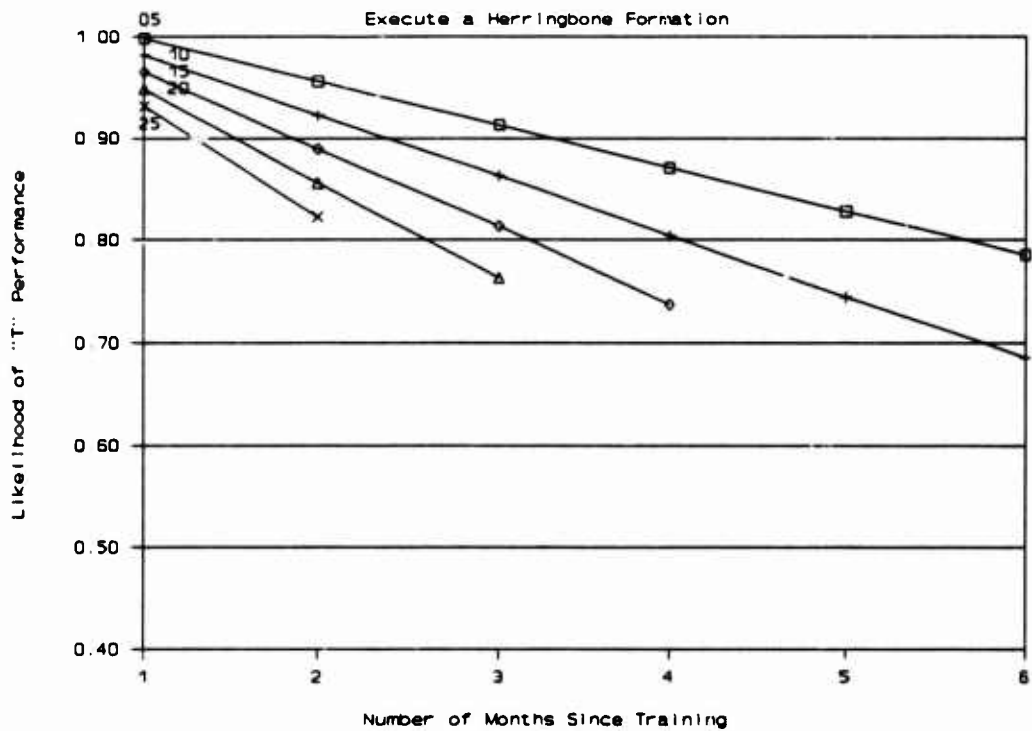
Perform Assembly Area Activities



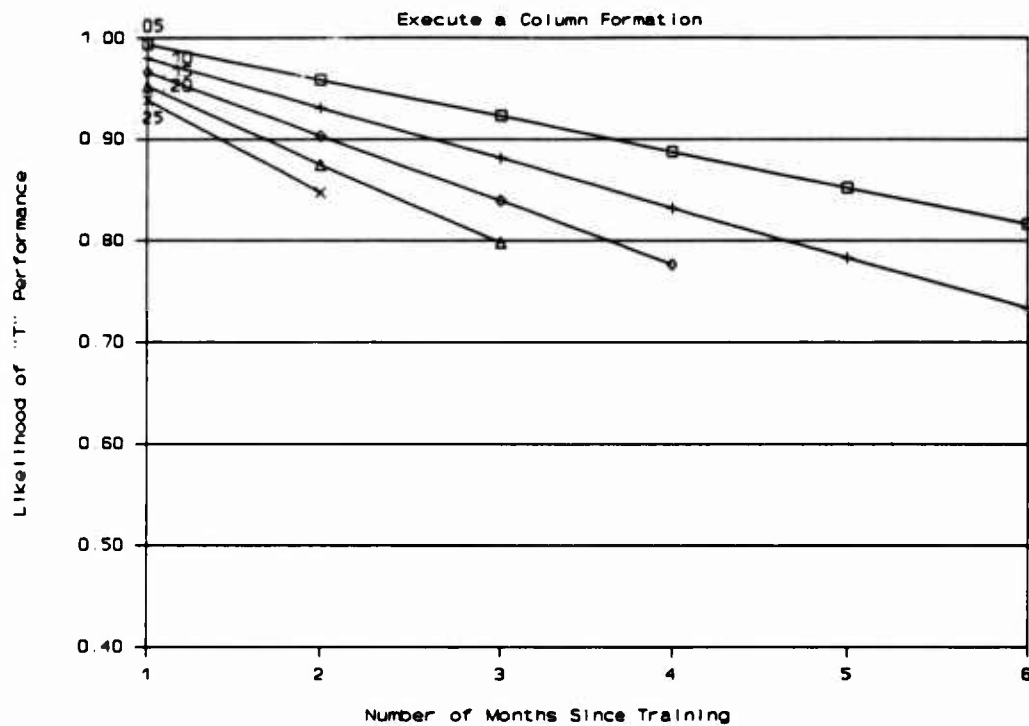
Armor Platoon Task



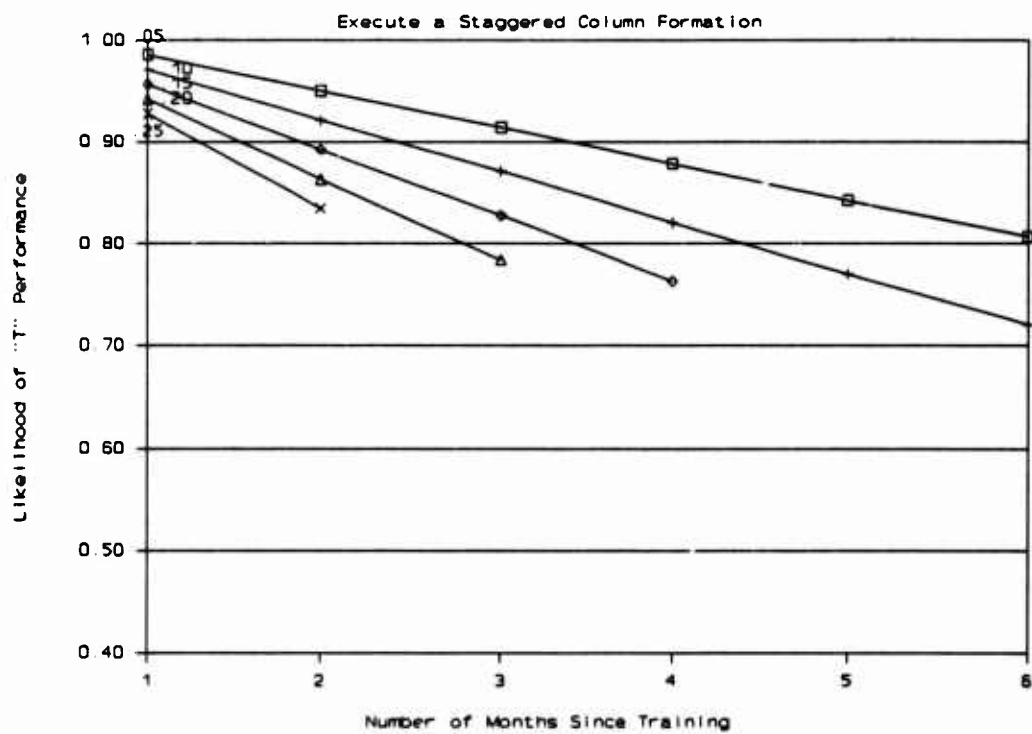
Armor Platoon Task



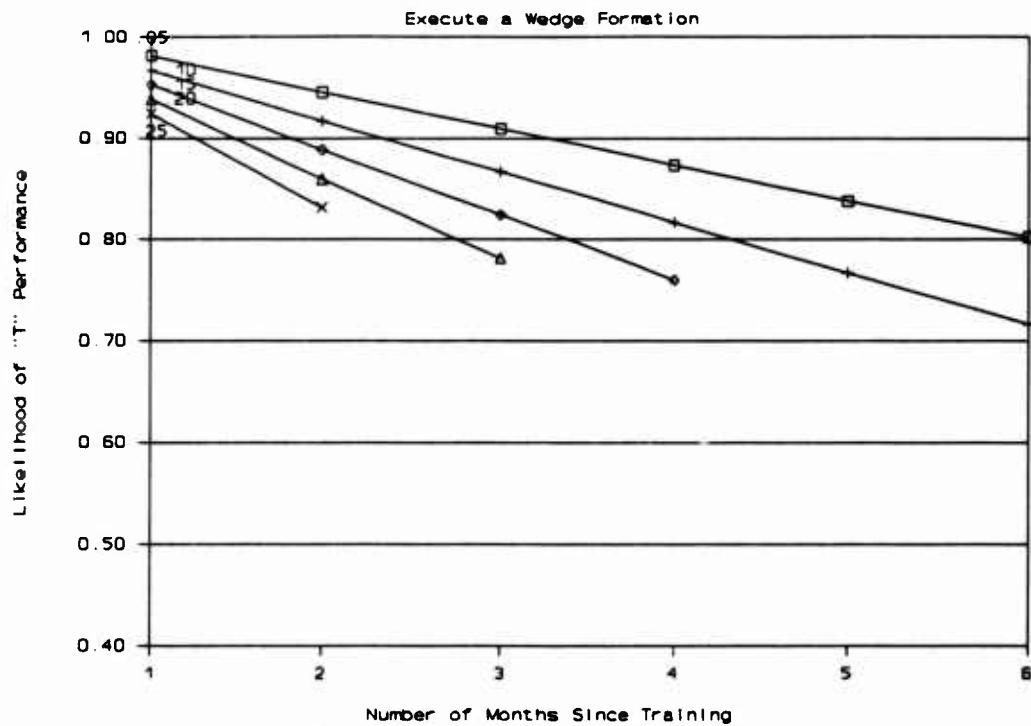
Armor Platoon Task



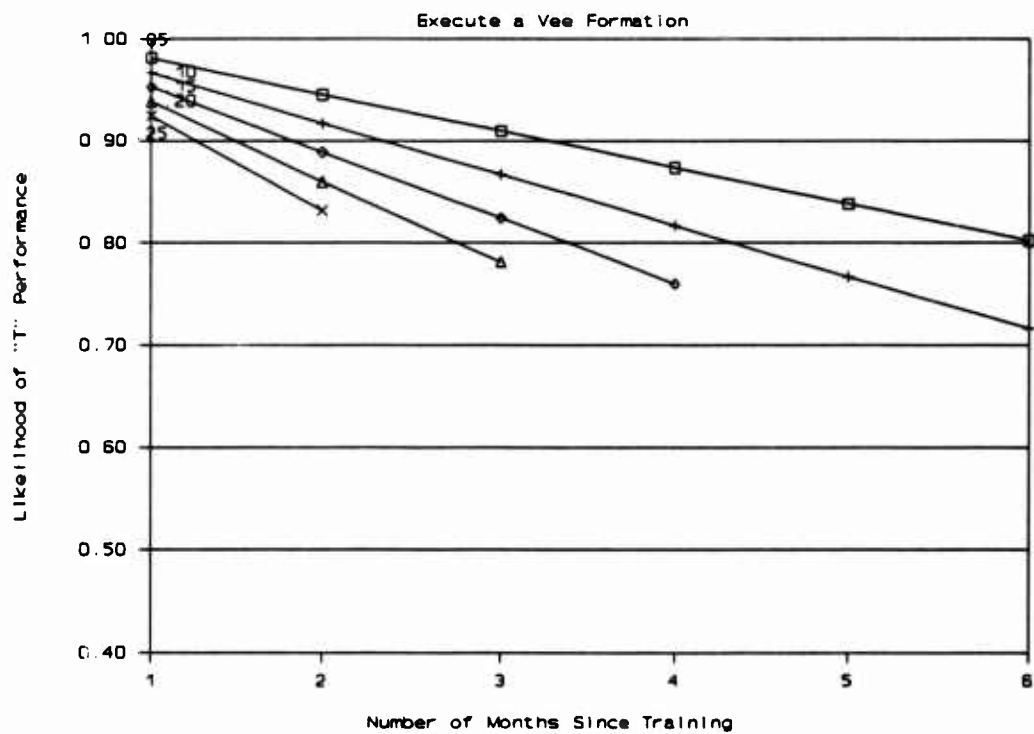
Armor Platoon Task



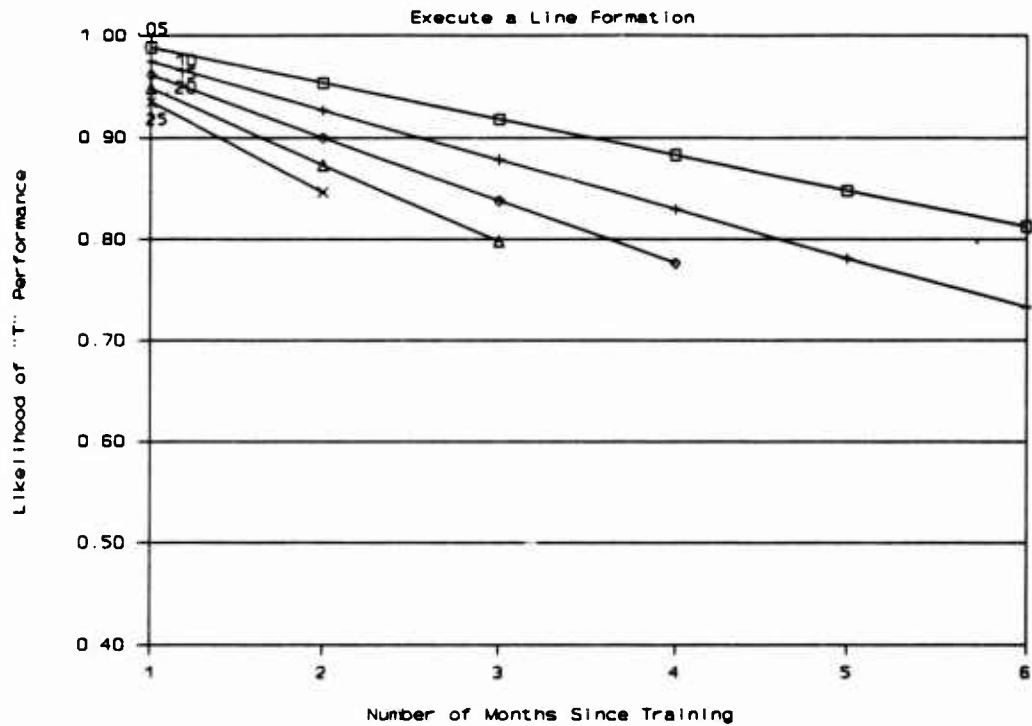
Armor Platoon Task



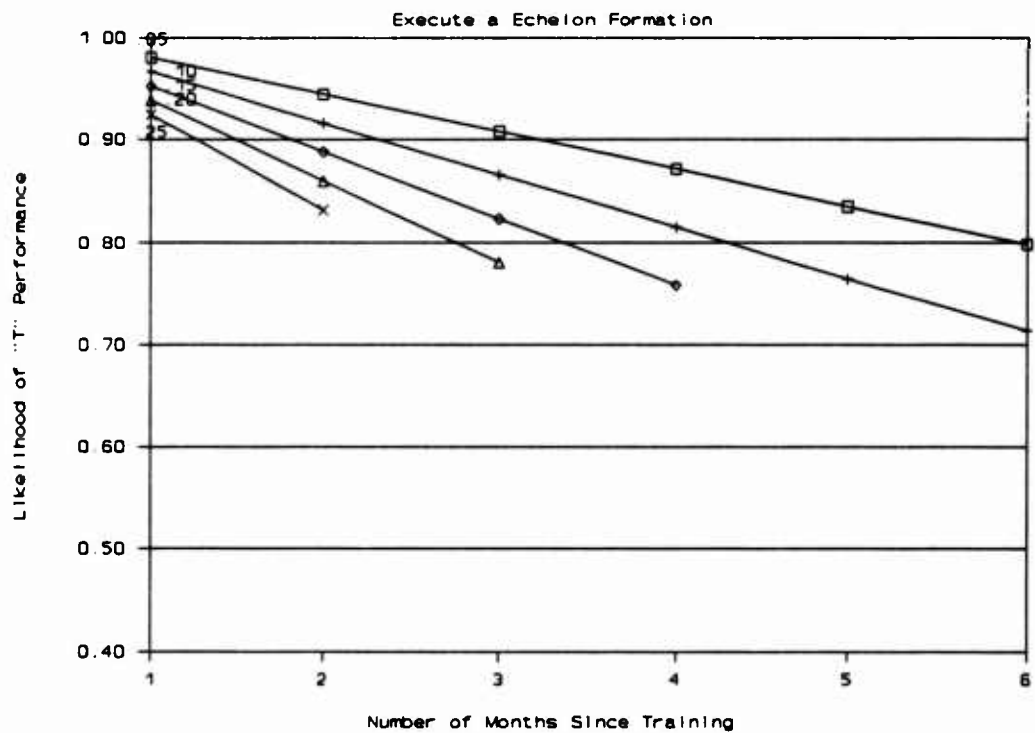
Armor Platoon Task



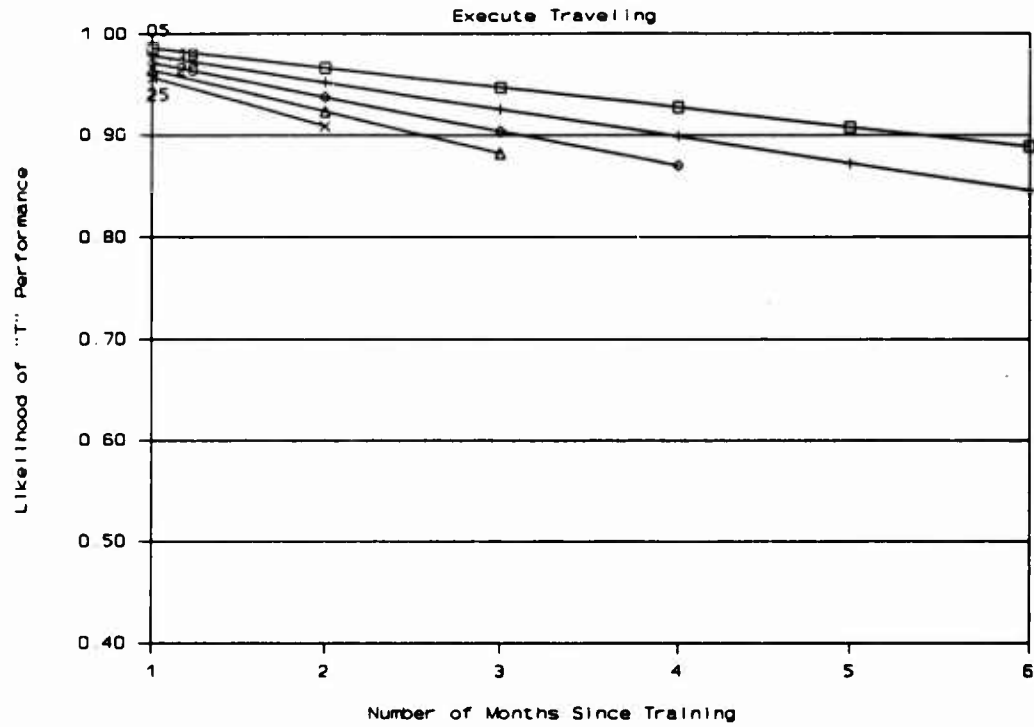
Armor Platoon Task



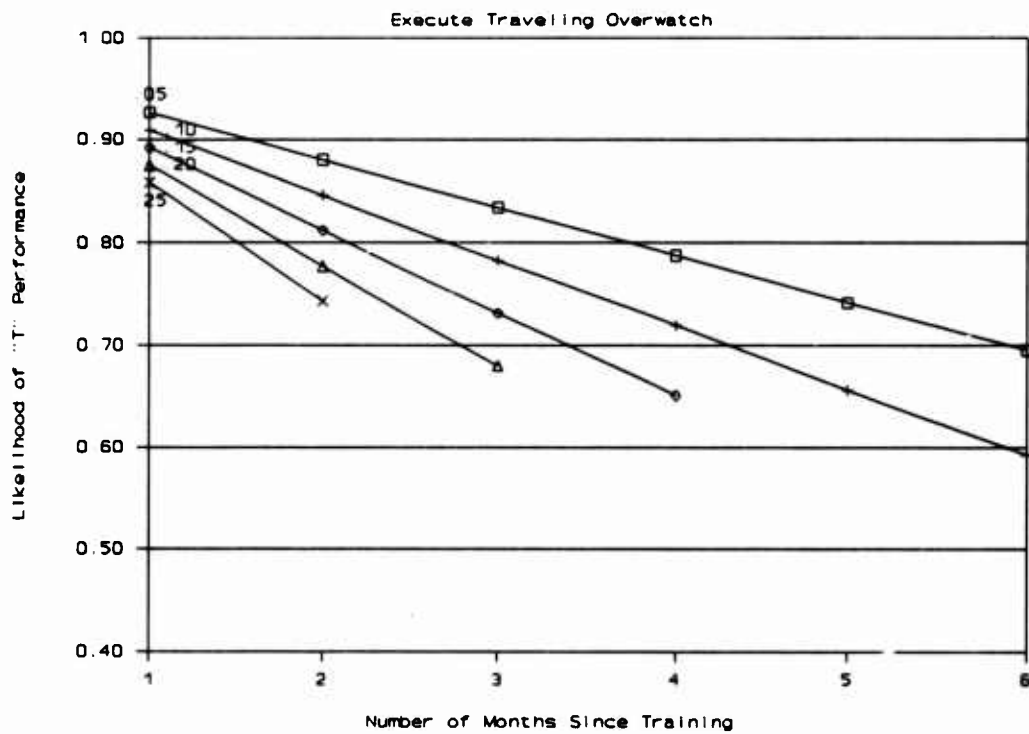
Armor Platoon Task



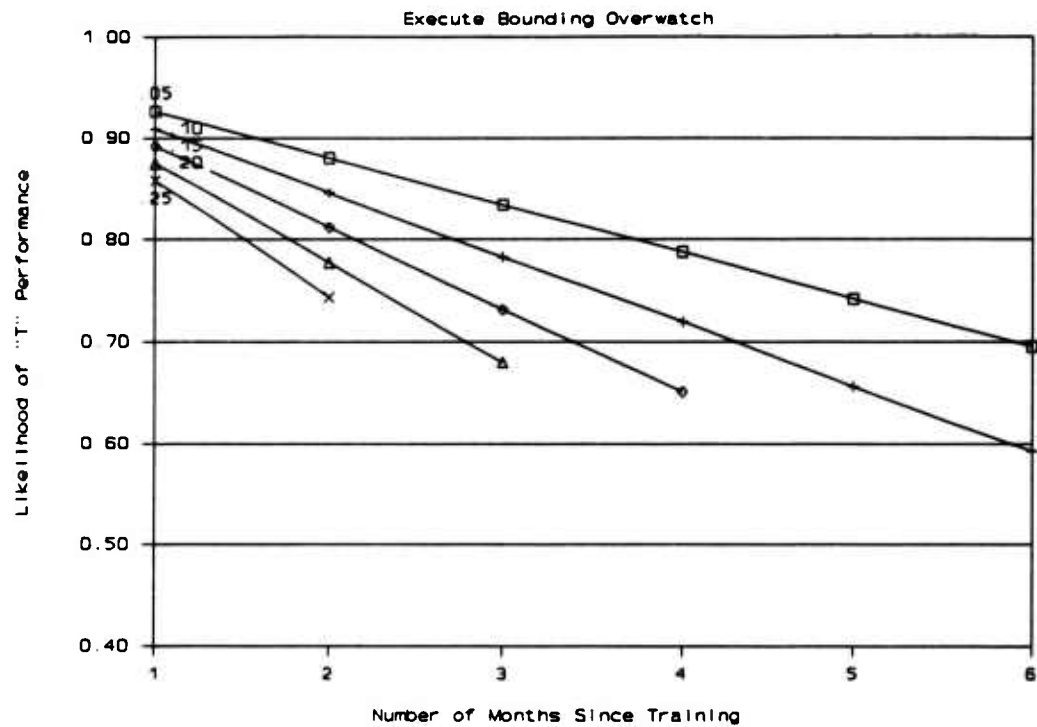
Armor Platoon Task



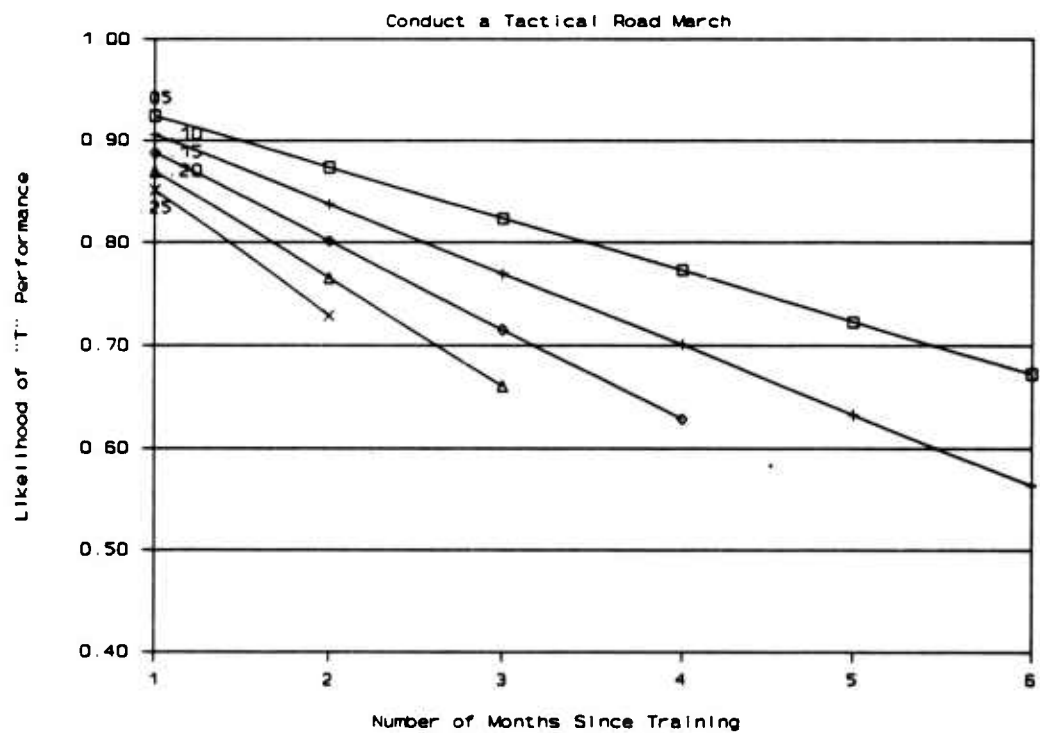
Armor Platoon Task



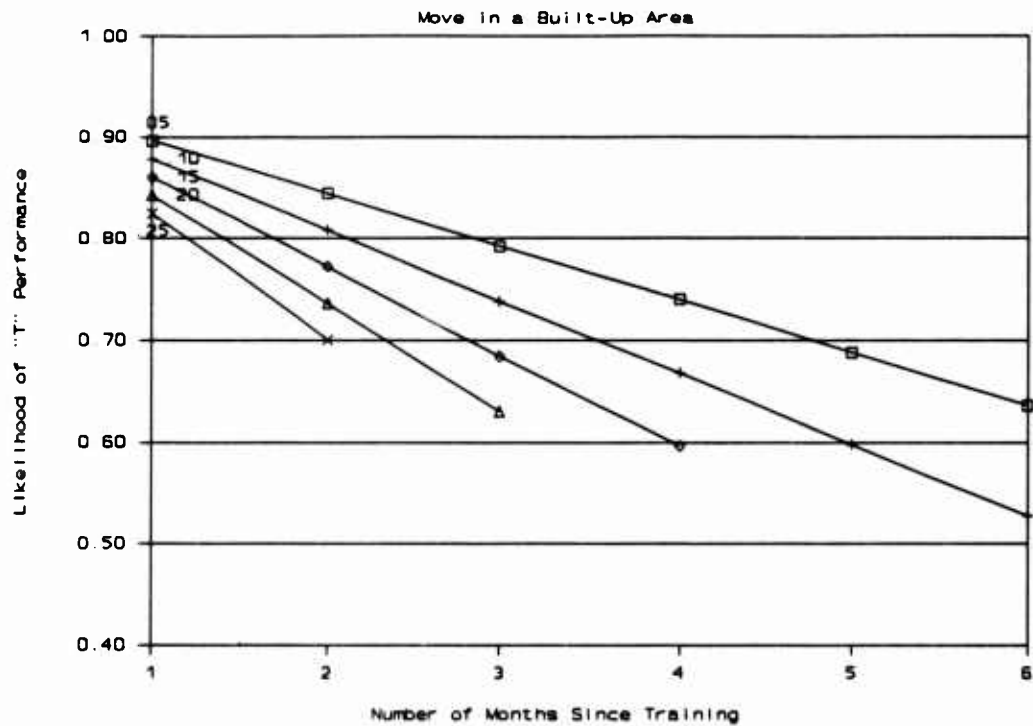
Armor Platoon Task



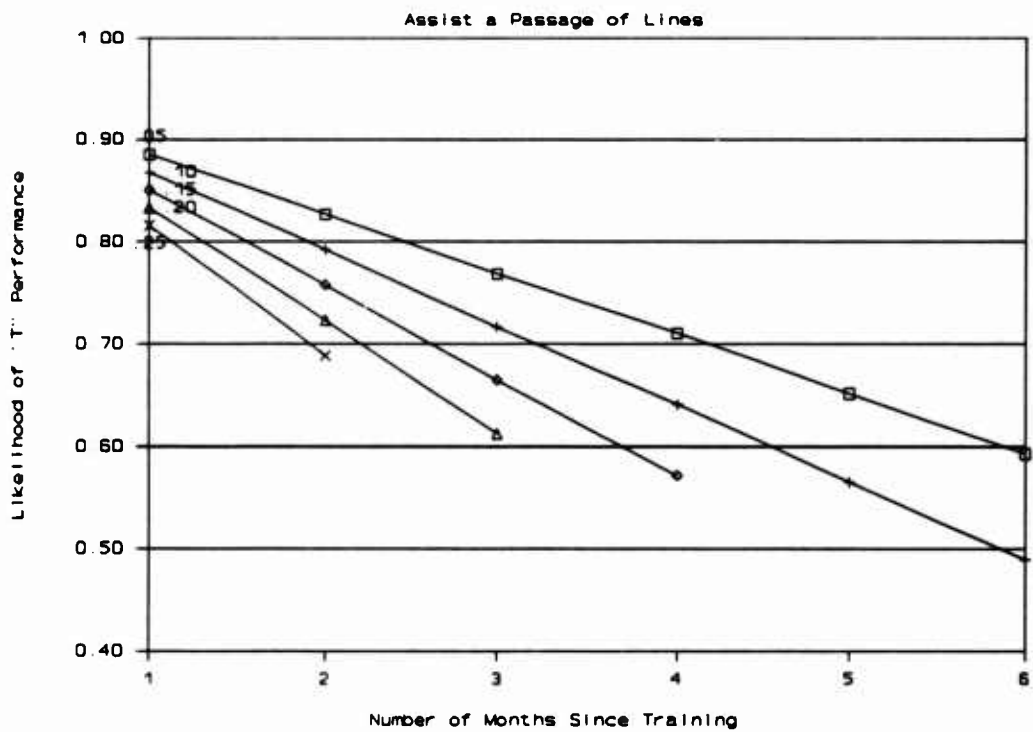
Armor Platoon Task



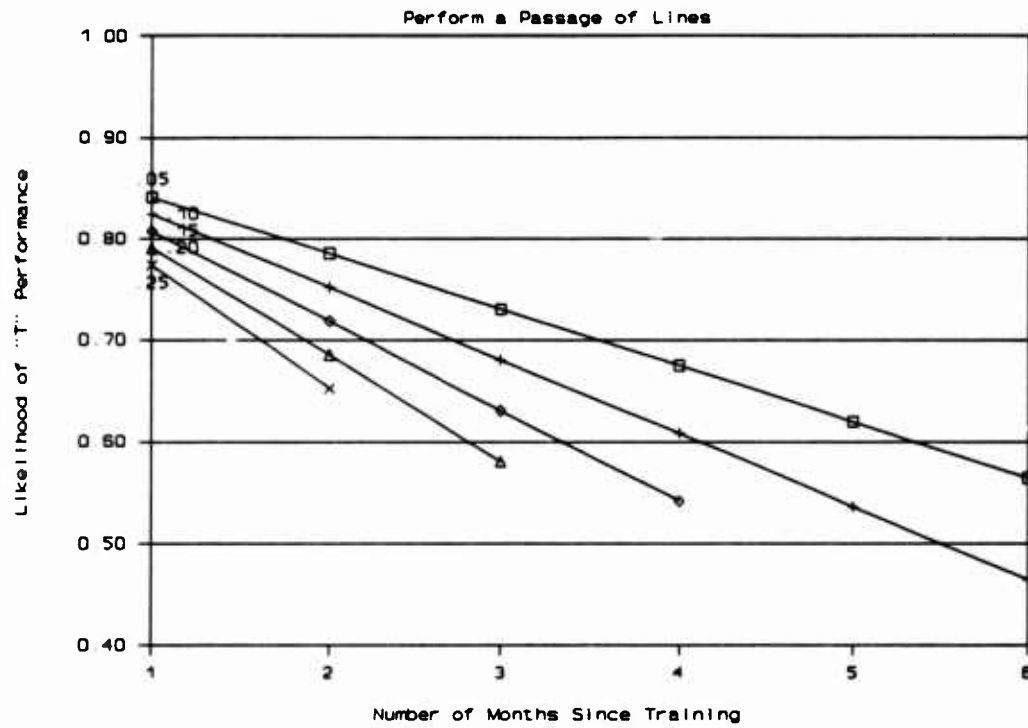
Armor Platoon Task



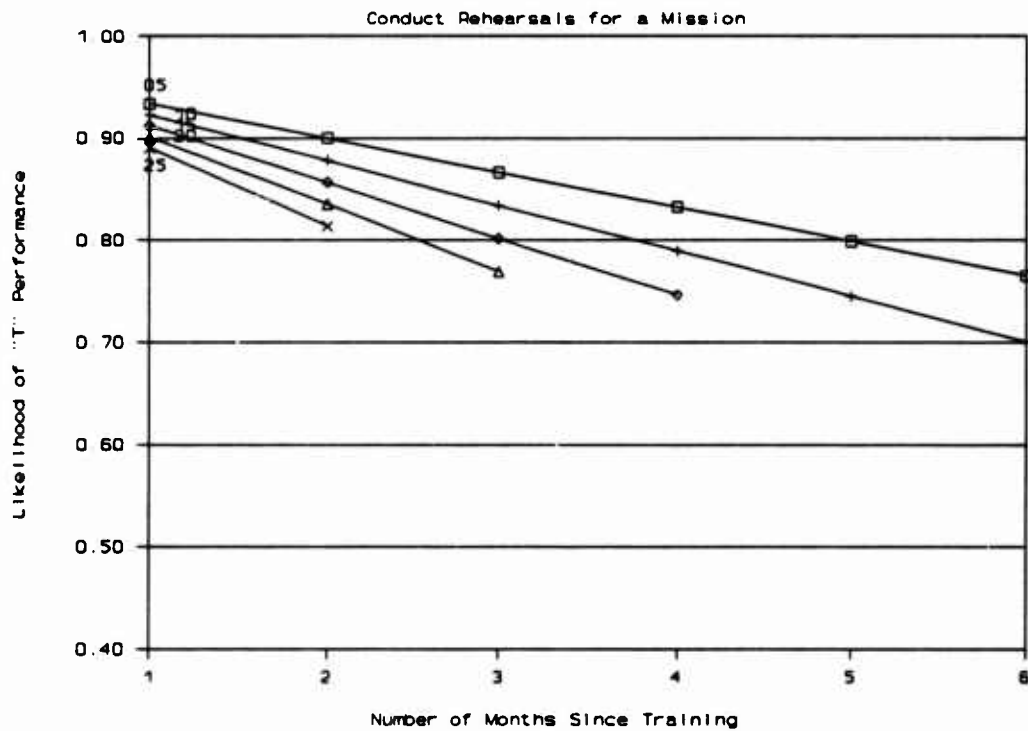
Armor Platoon Task



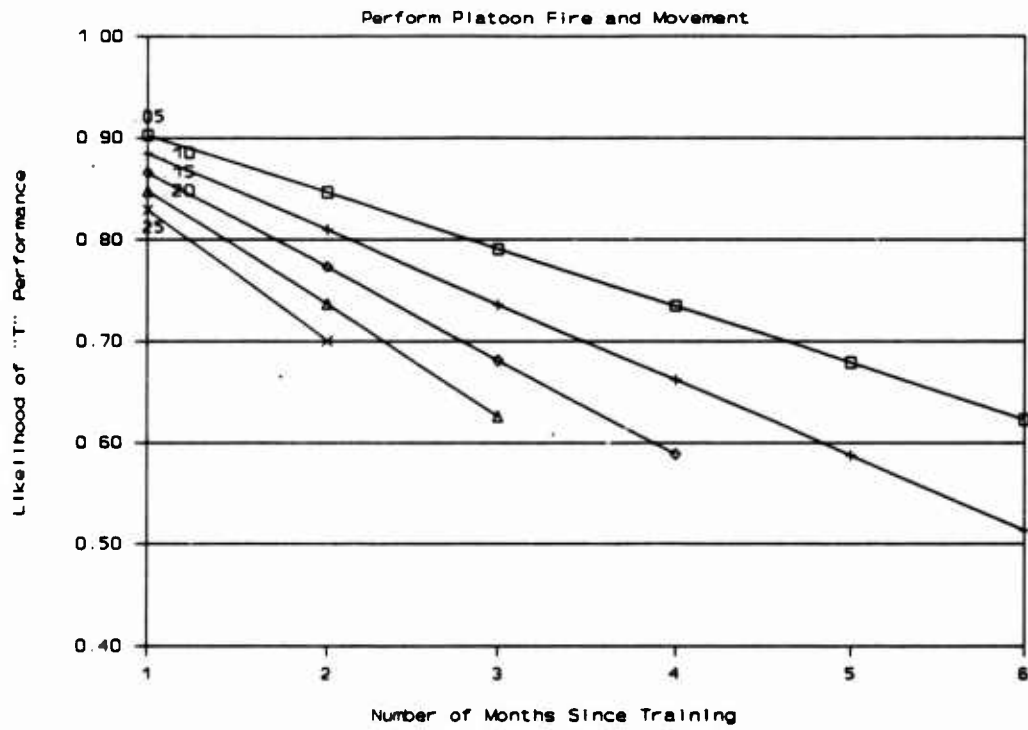
Armor Platoon Task



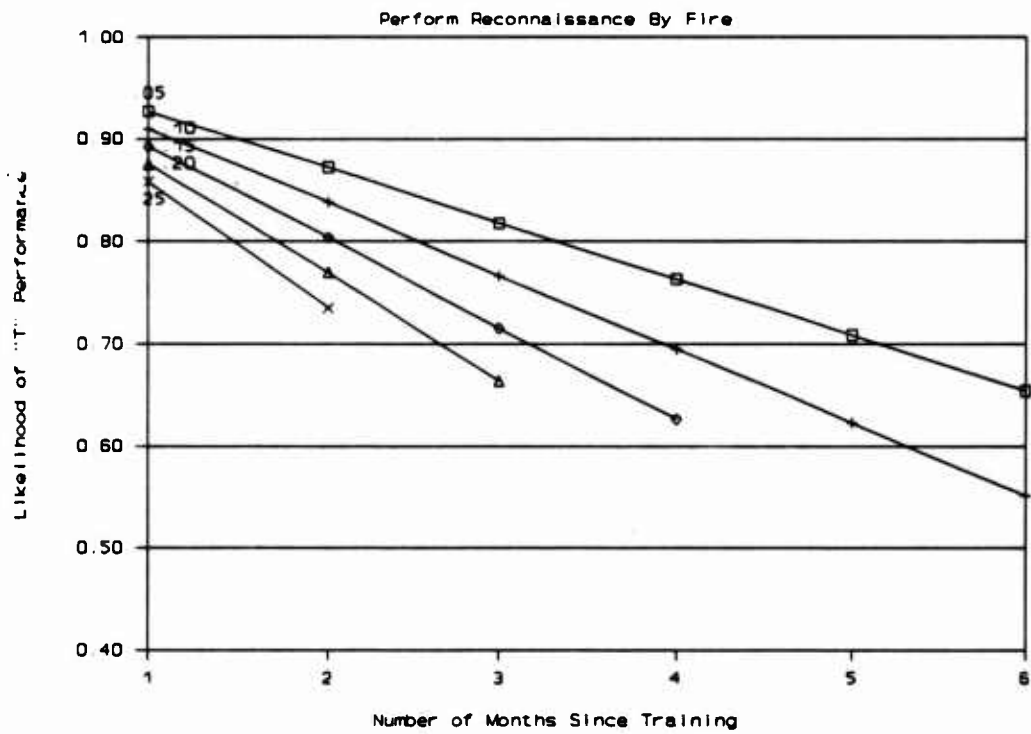
Armor Platoon Task



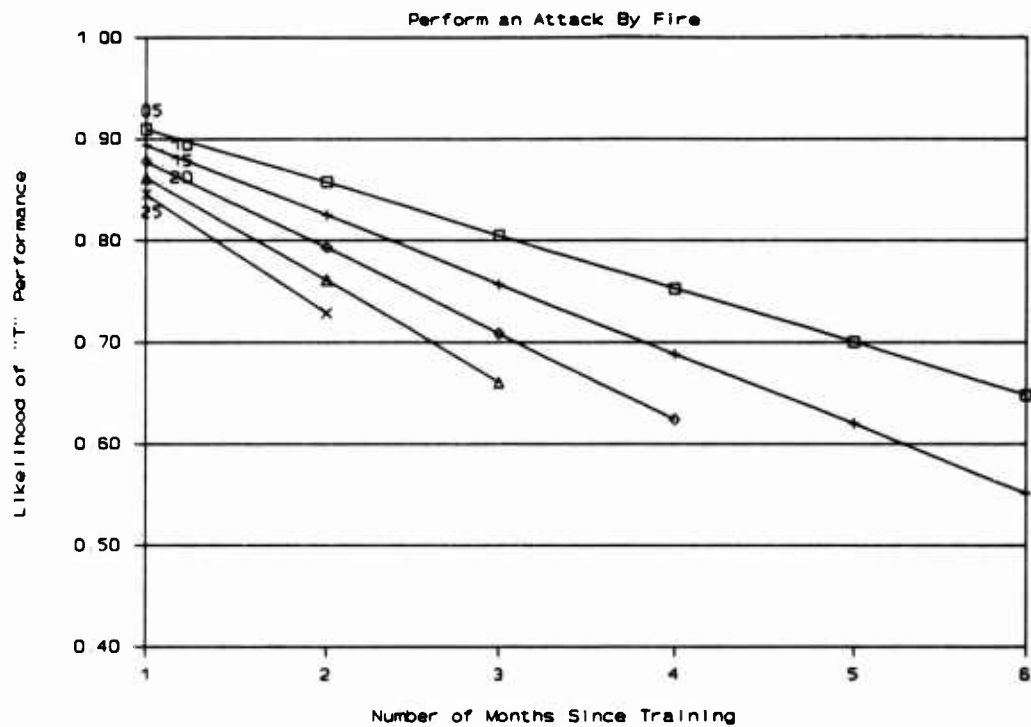
Armor Platoon Task



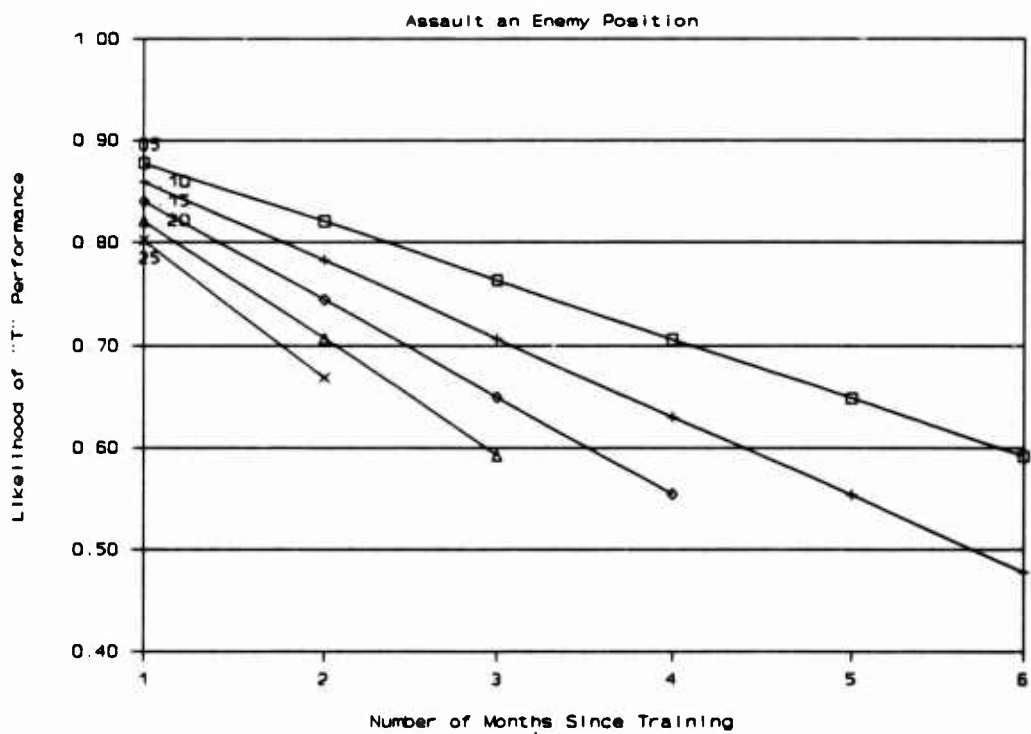
Armor Platoon Task



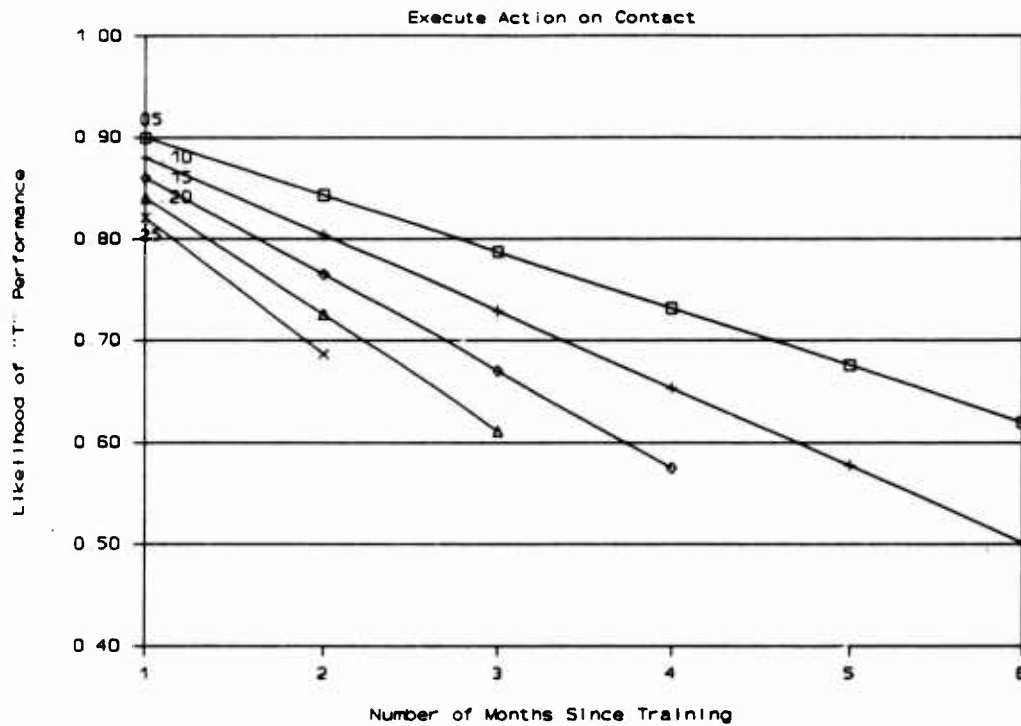
Armor Platoon Task



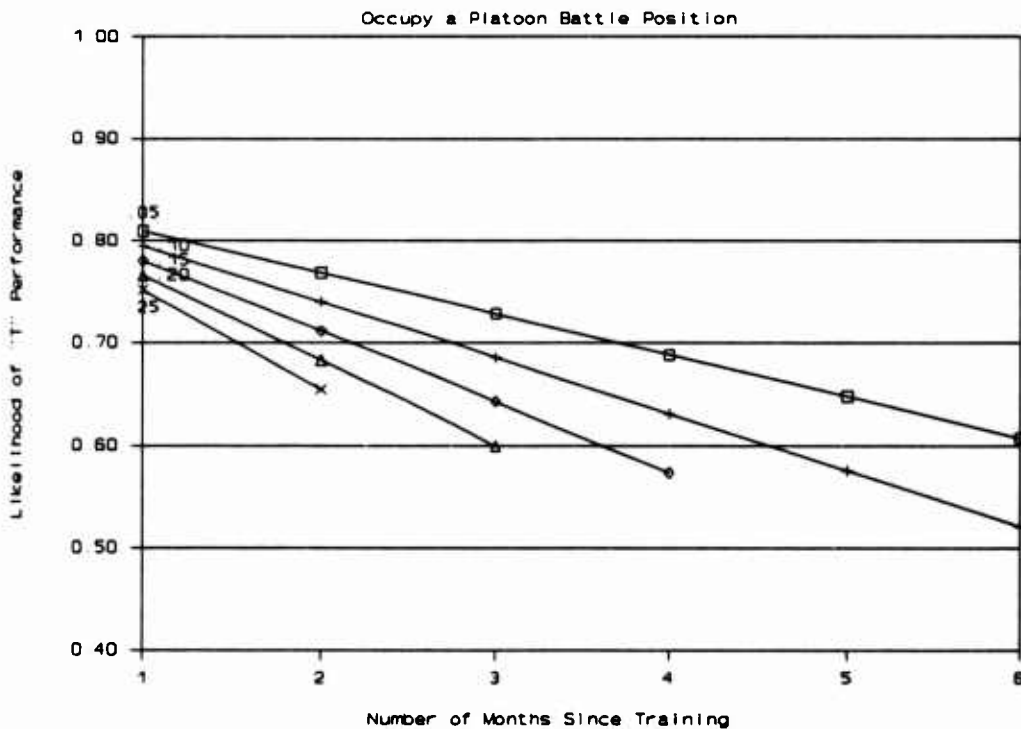
Armor Platoon Task



Armor Platoon Task

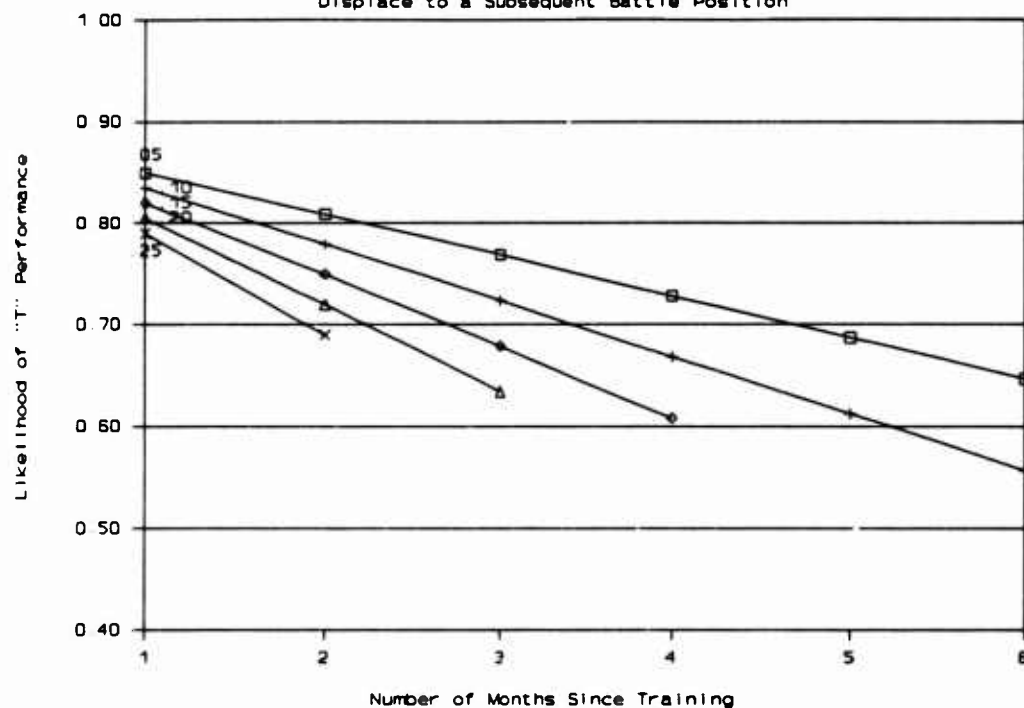


Armor Platoon Task



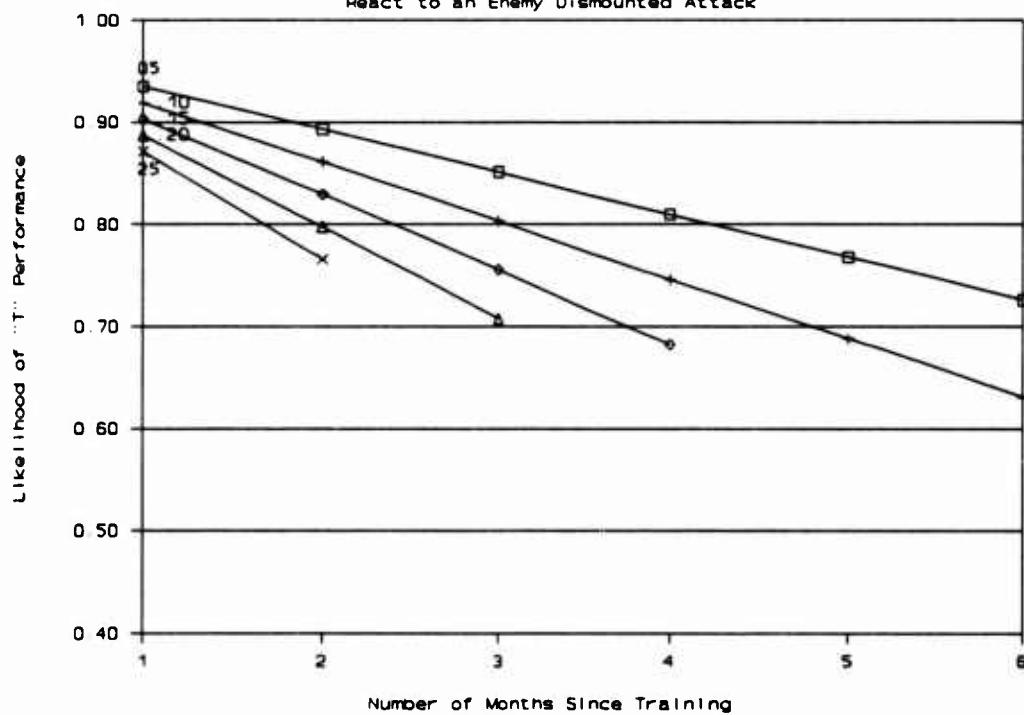
Armor Platoon Task

Displace to a Subsequent Battle Position



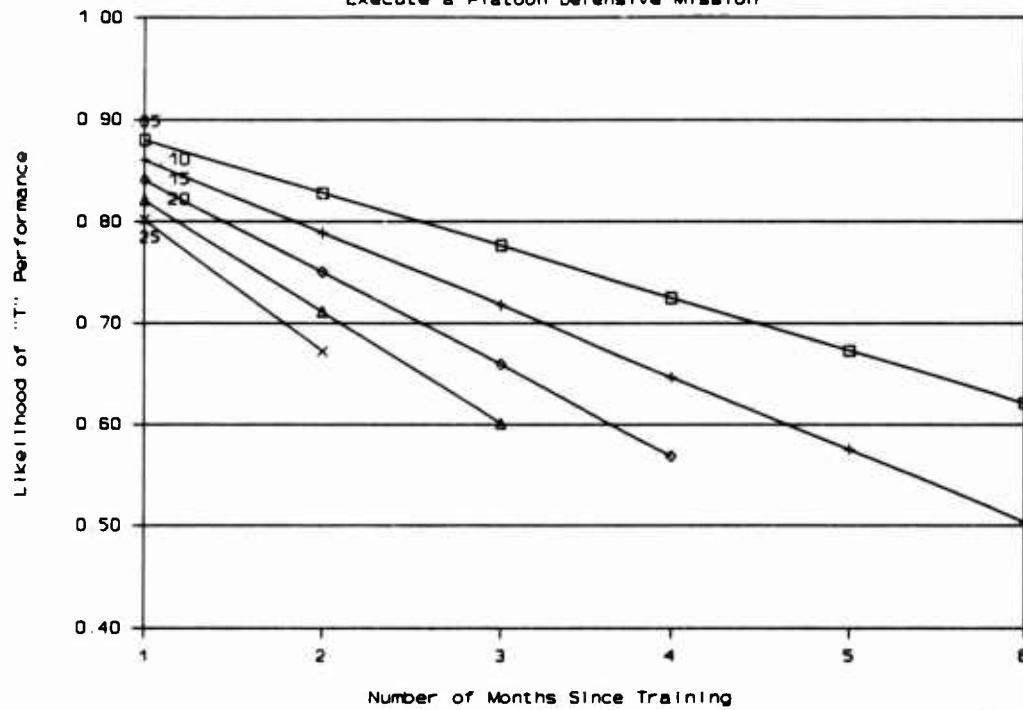
Armor Platoon Task

React to an Enemy Dismounted Attack



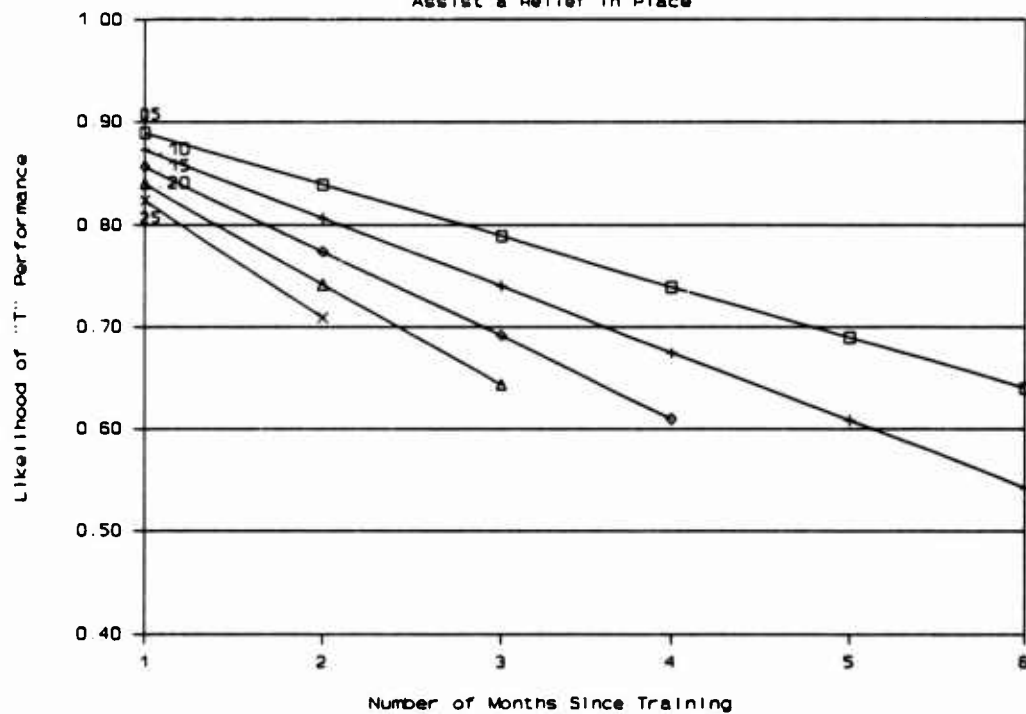
Armor Platoon Task

Execute a Platoon Defensive Mission



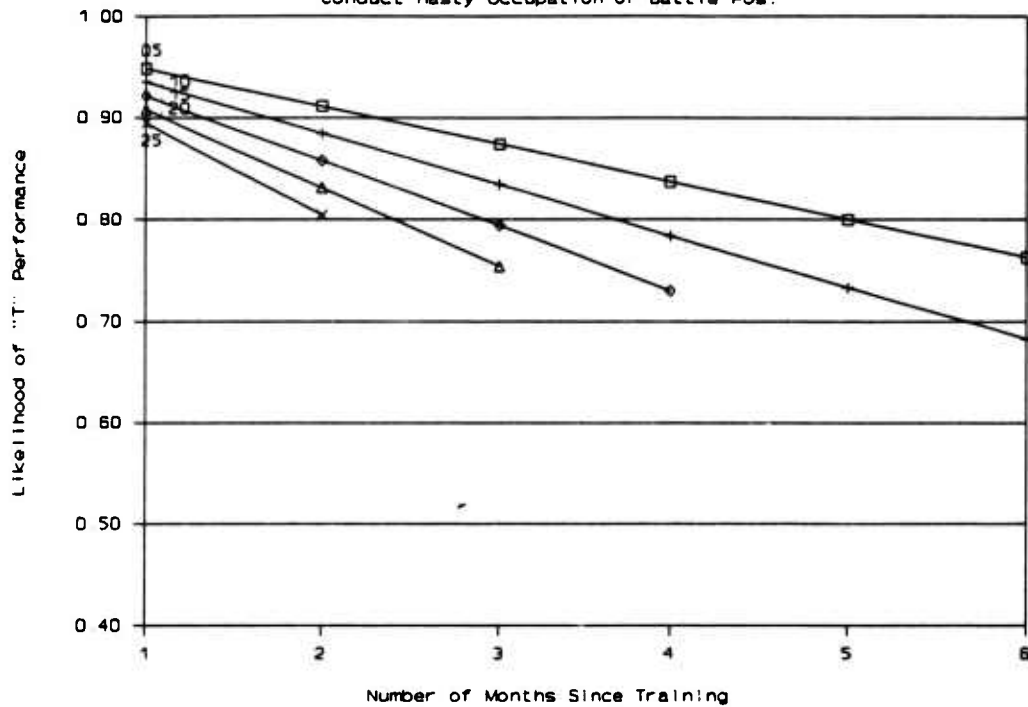
Armor Platoon Task

Assist a Relief in Place



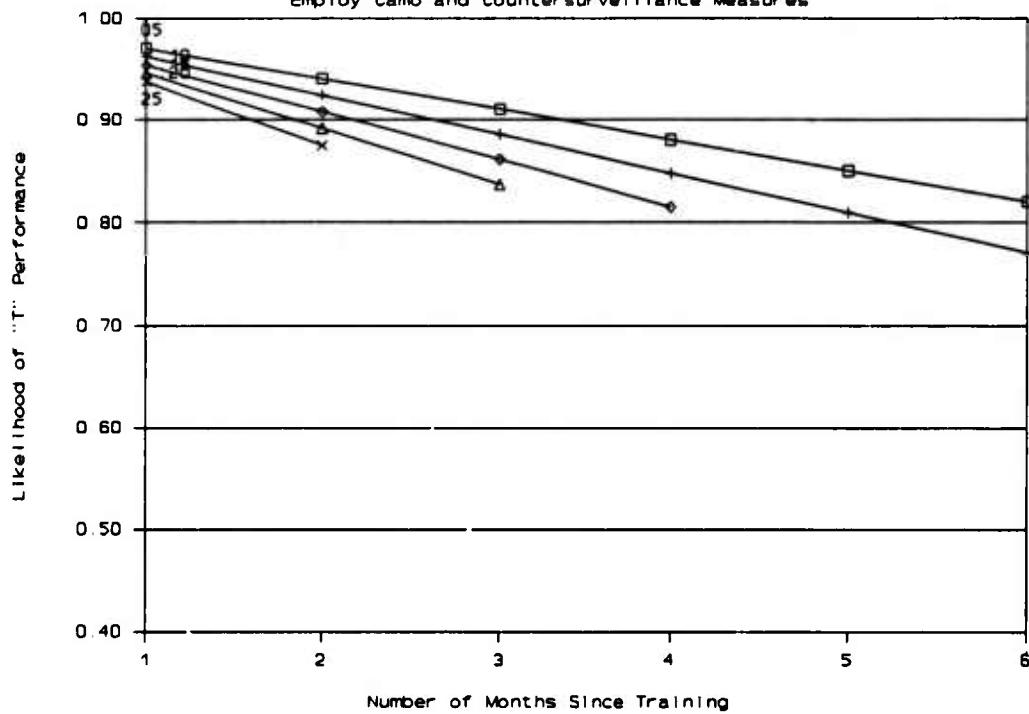
Armor Platoon Task

Conduct Hasty Occupation of Battle Pos.

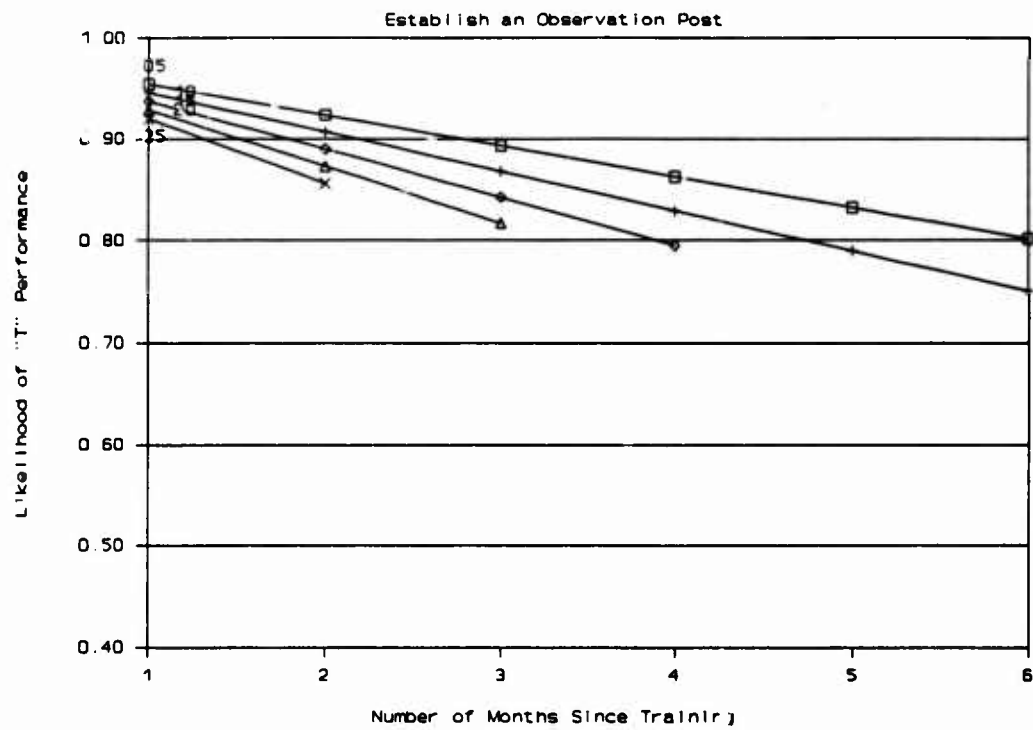


Armor Platoon Task

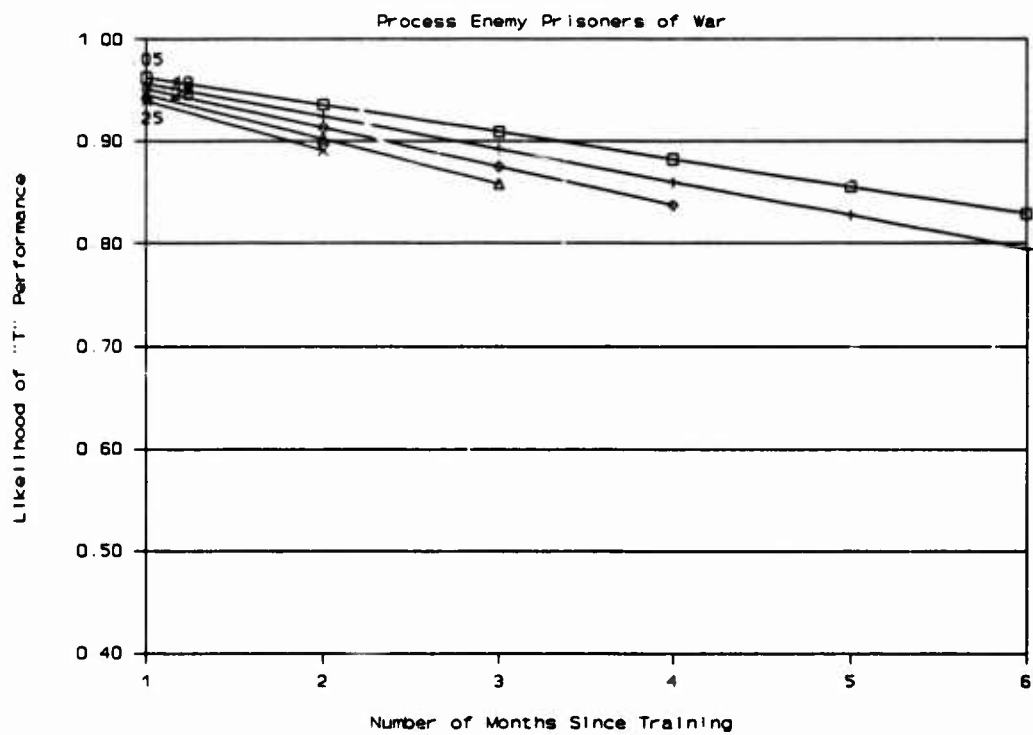
Employ Camo and Countersurveillance Measures



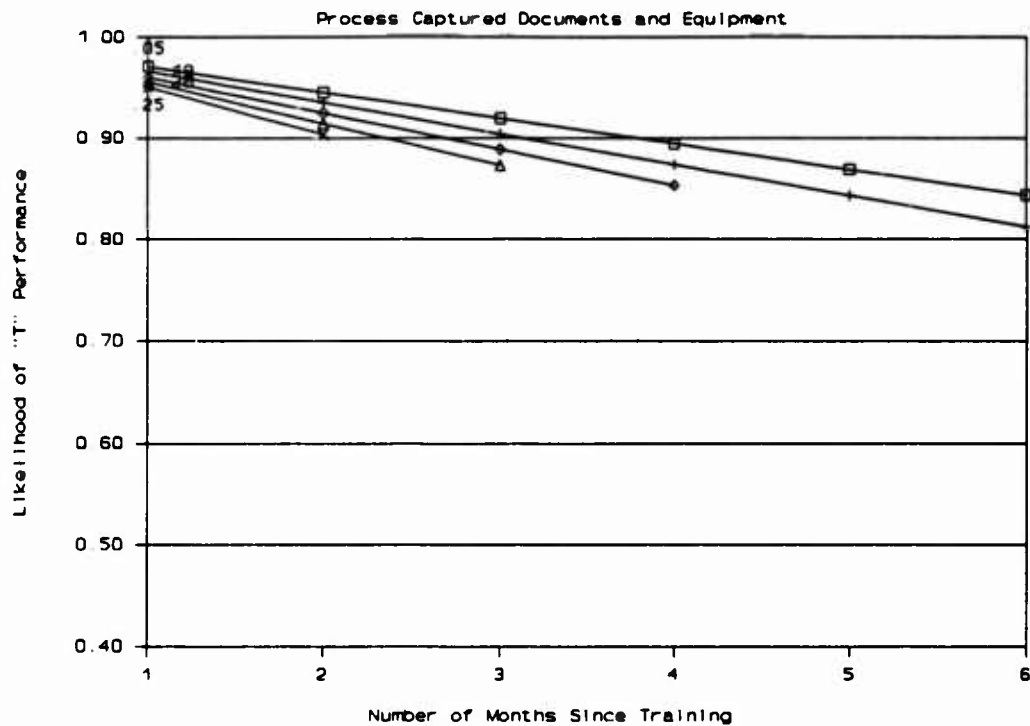
Armor Platoon Task



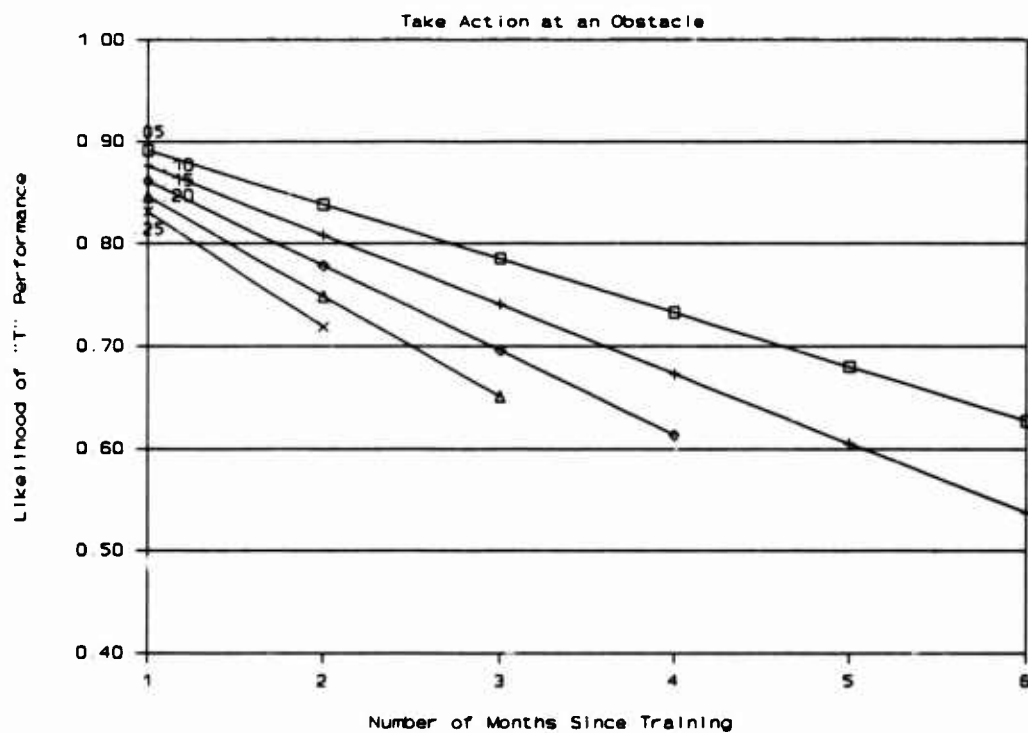
Armor Platoon Task



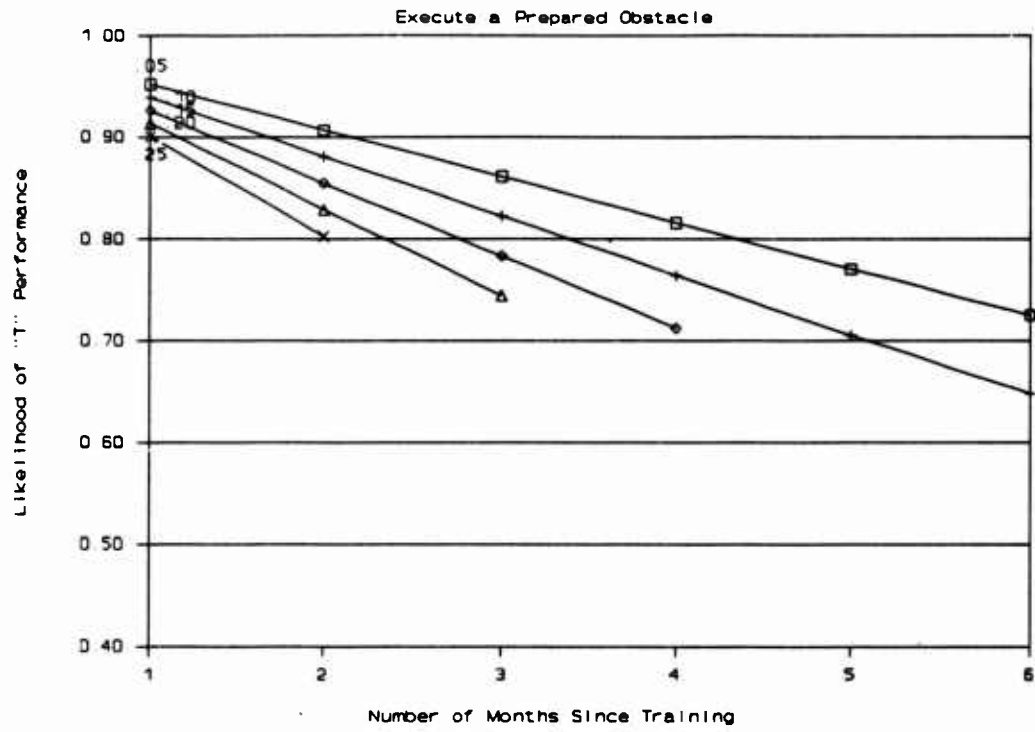
Armor Platoon Task



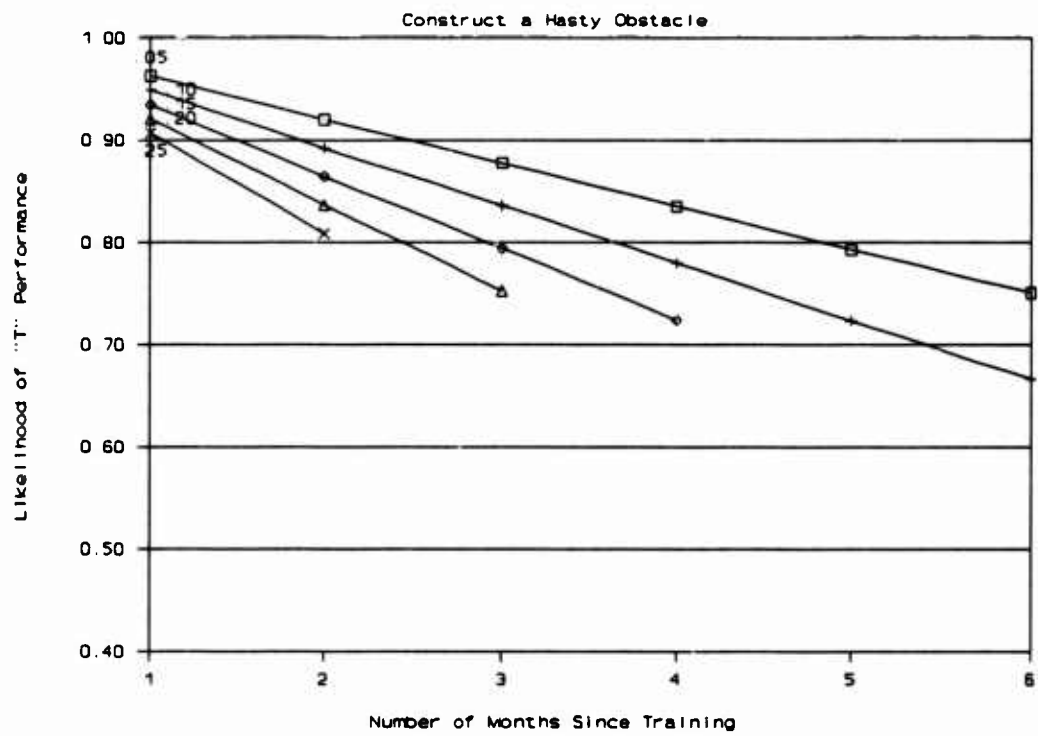
Armor Platoon Task



Armor Platoon Task

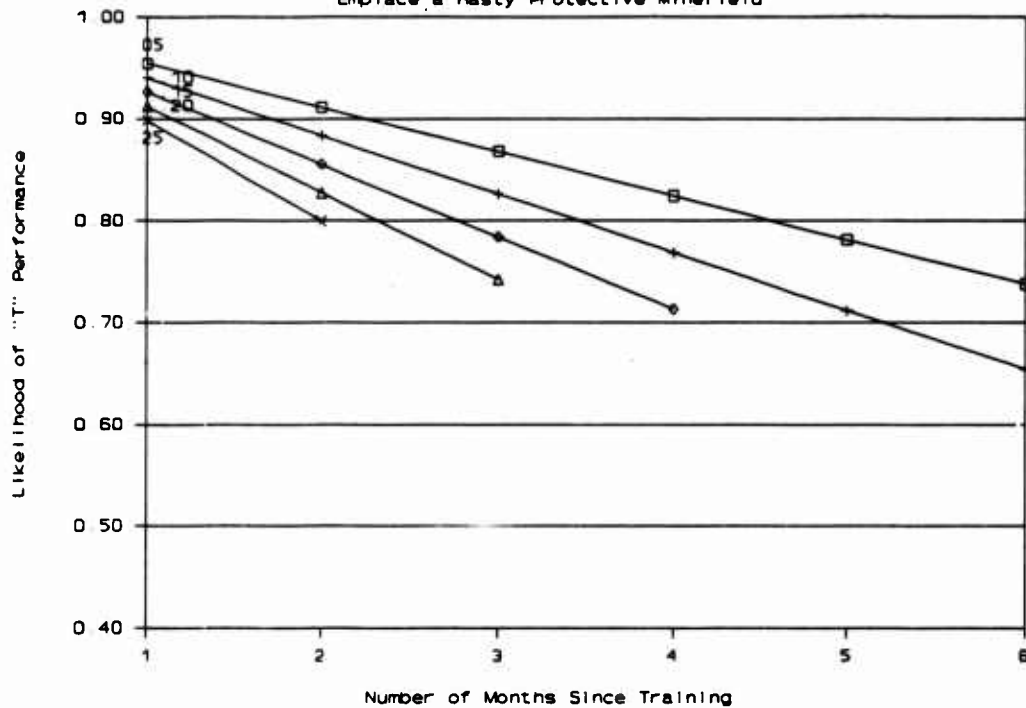


Armor Platoon Task



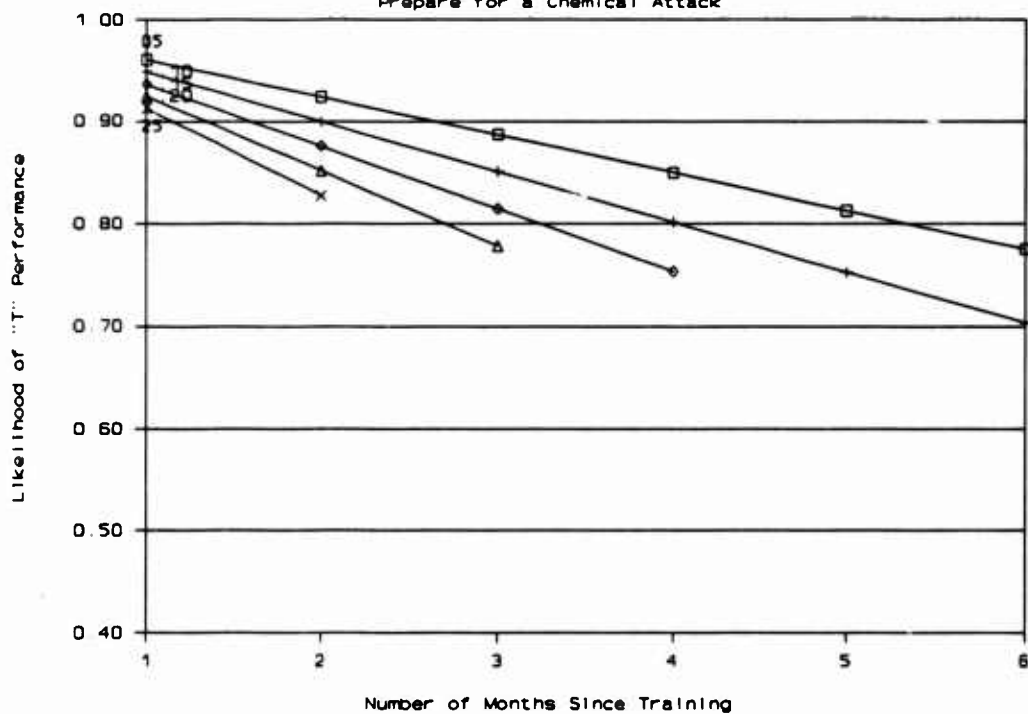
Armor Platoon Task

Emplace a Hasty Protective Minefield

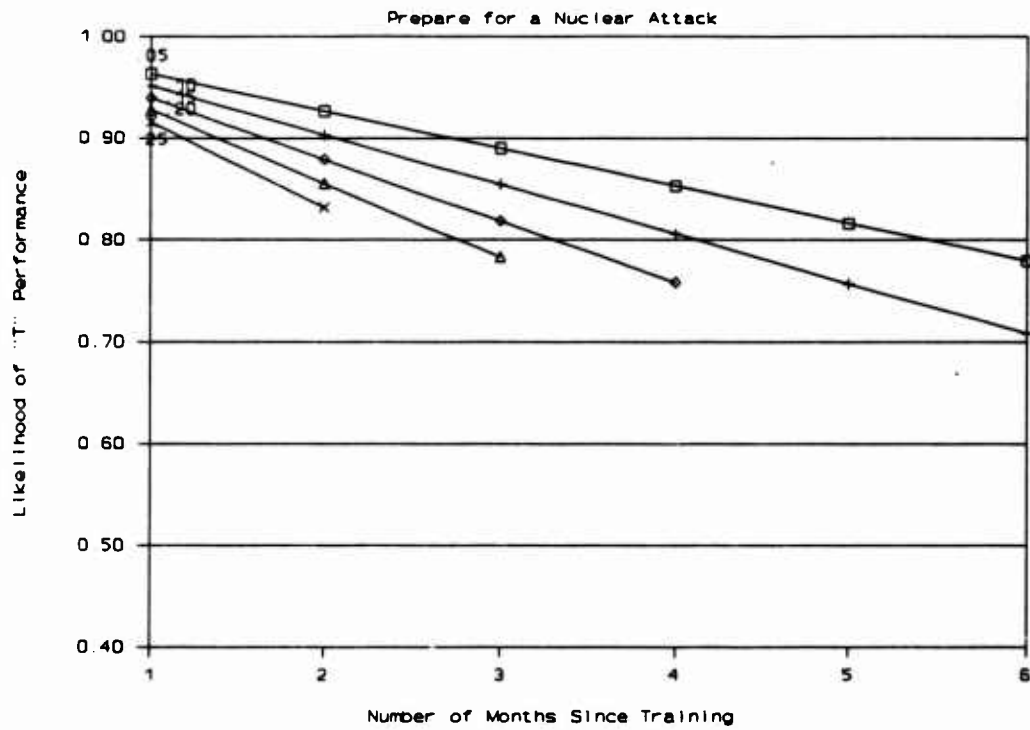


Armor Platoon Task

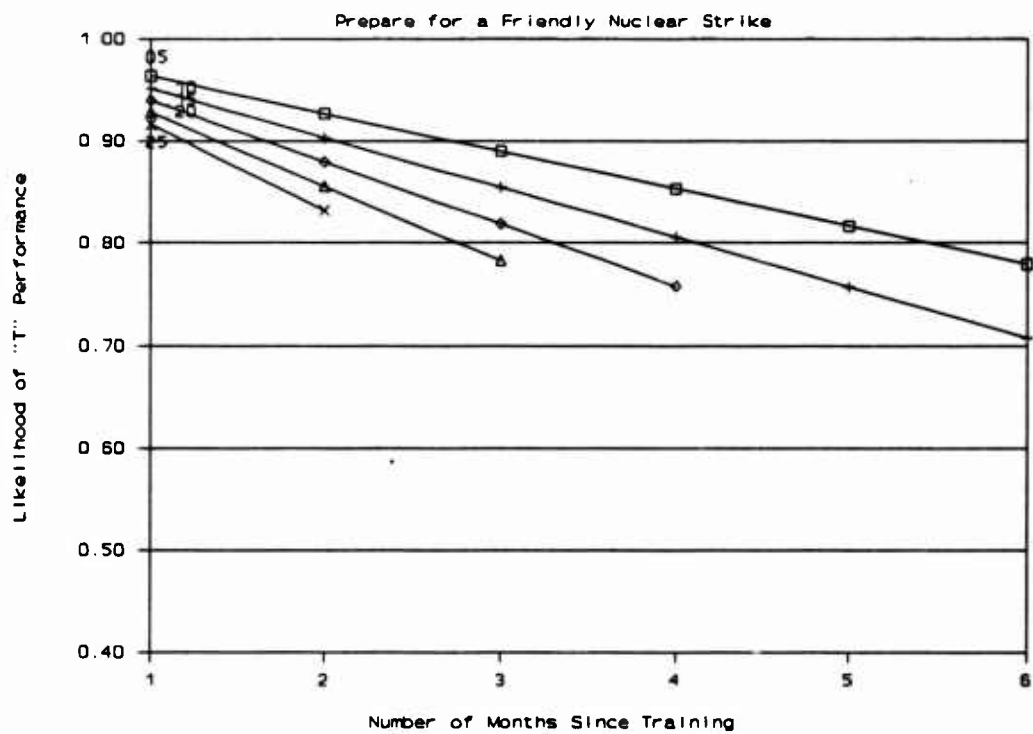
Prepare for a Chemical Attack



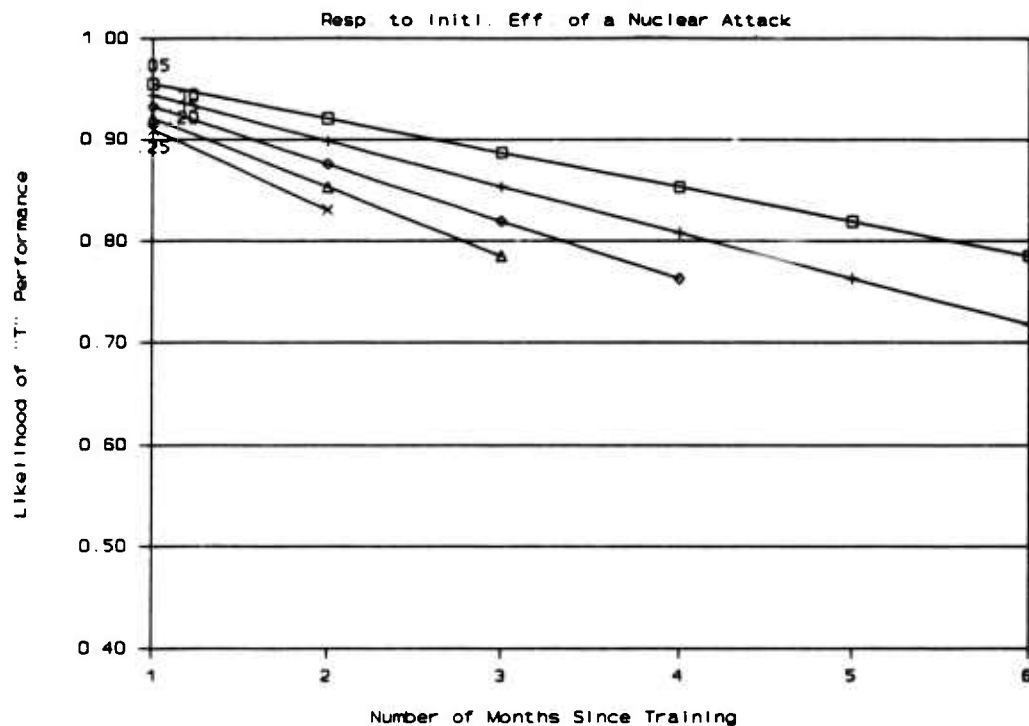
Armor Platoon Task



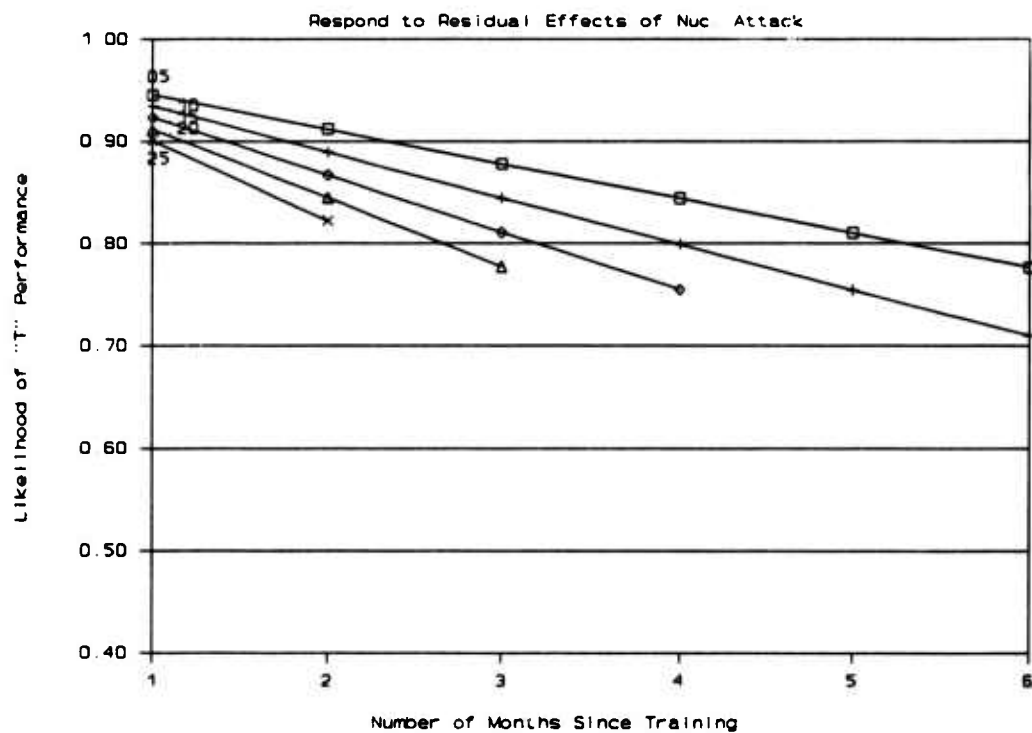
Armor Platoon Task



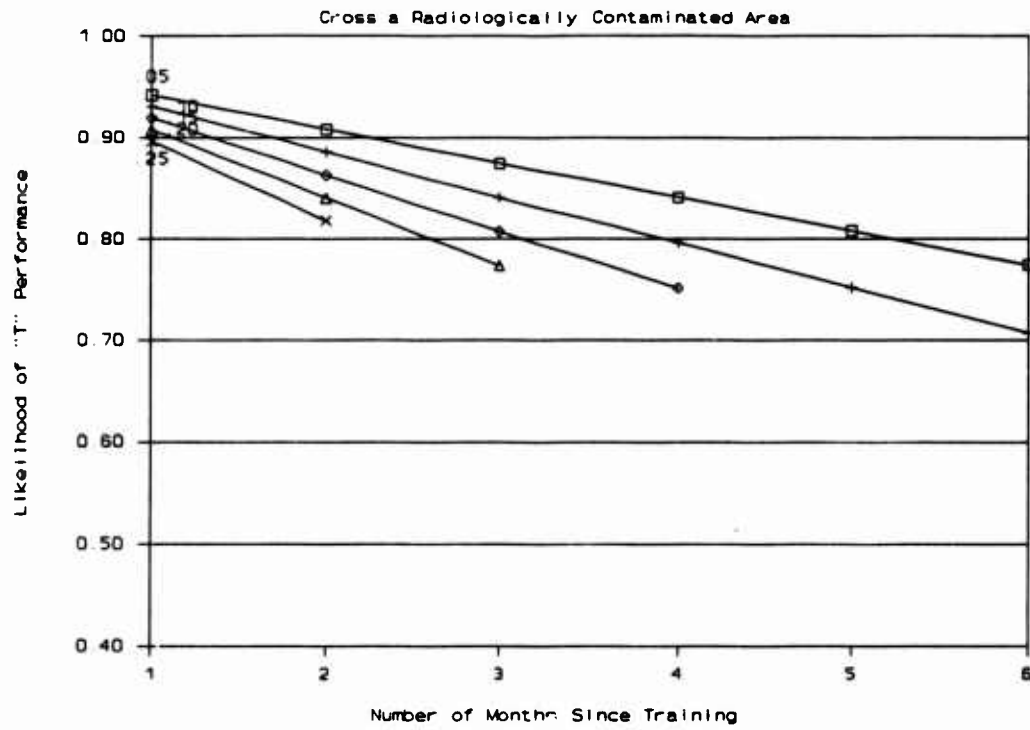
Armor Platoon Task



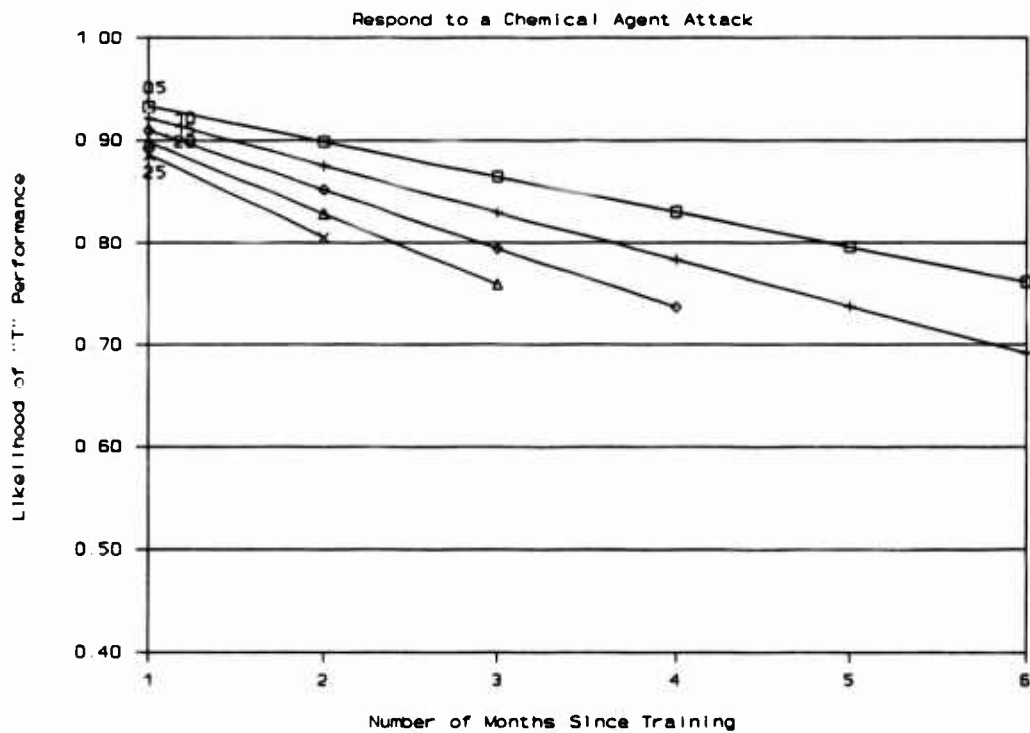
Armor Platoon Task



Armor Platoon Task

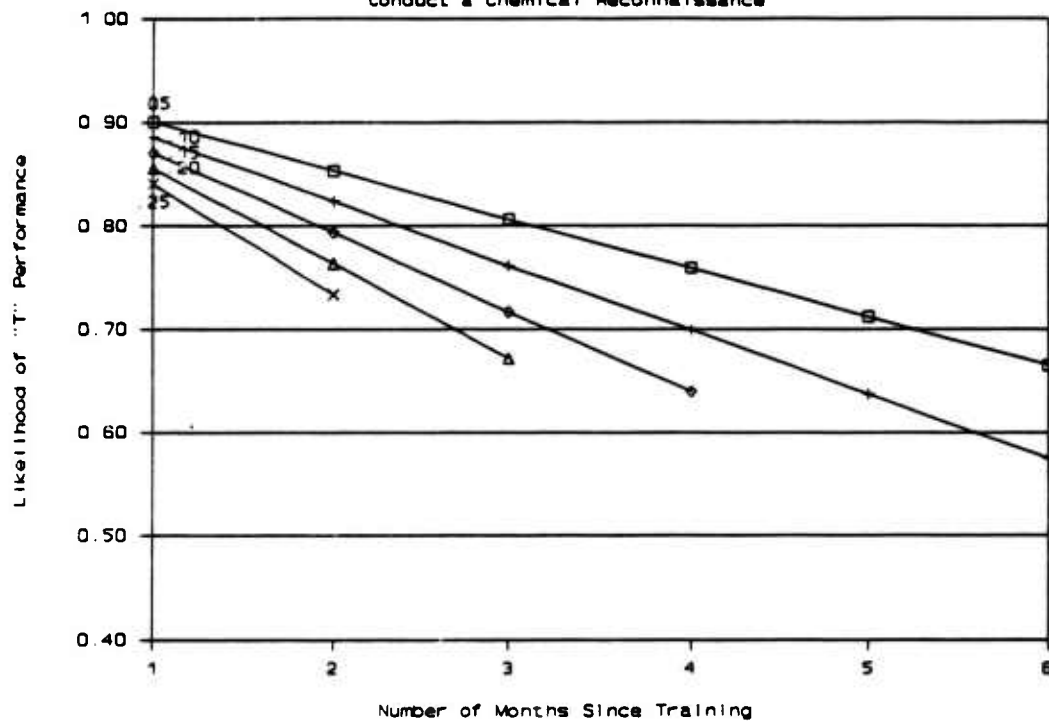


Armor Platoon Task



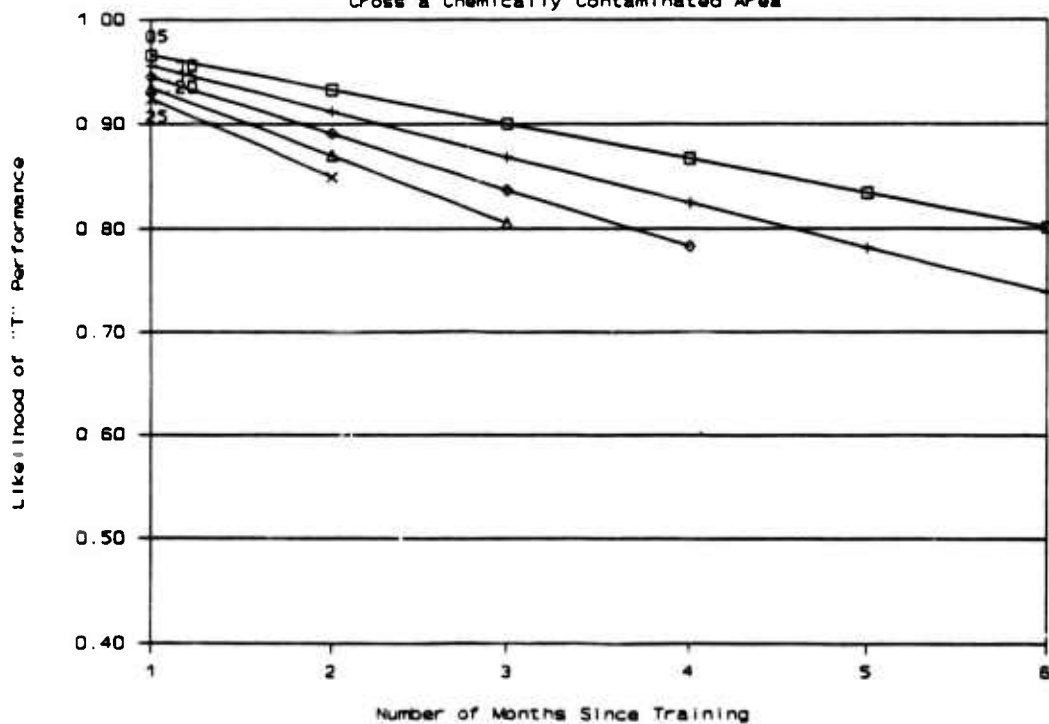
Armor Platoon Task

Conduct a Chemical Reconnaissance

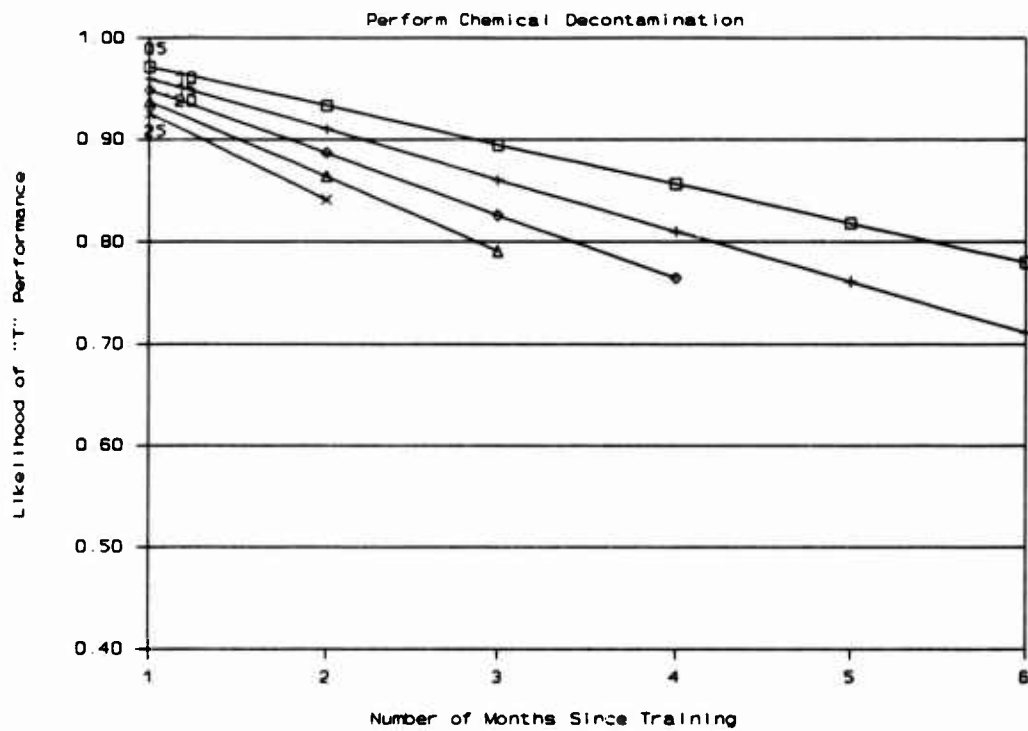


Armor Platoon Task

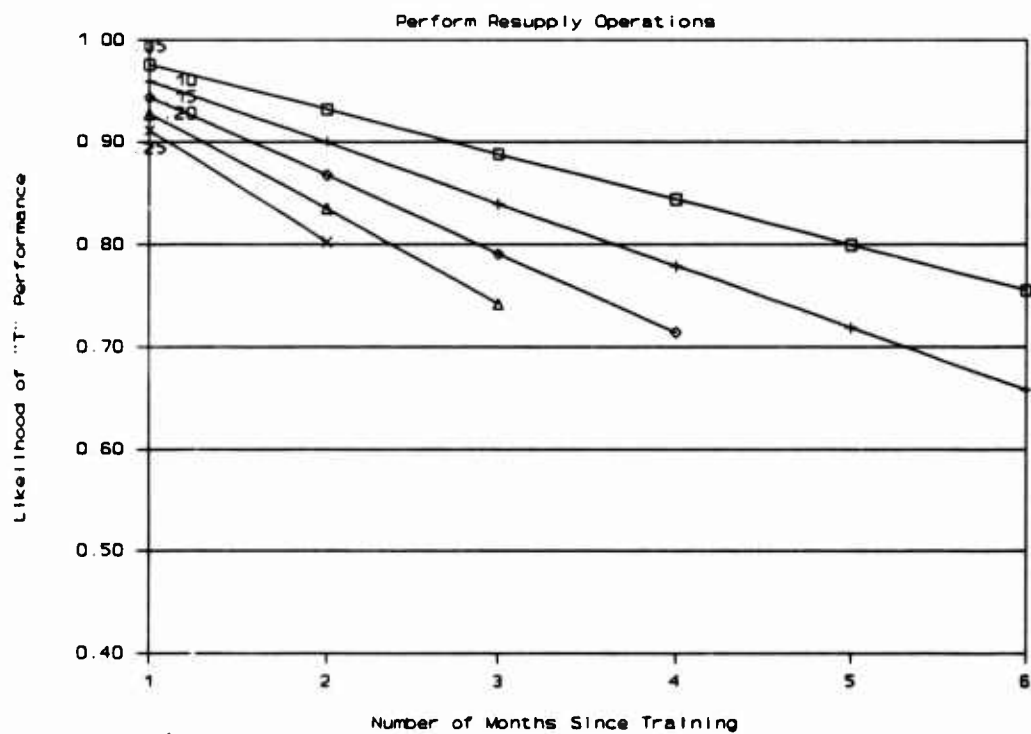
Cross a Chemically Contaminated Area



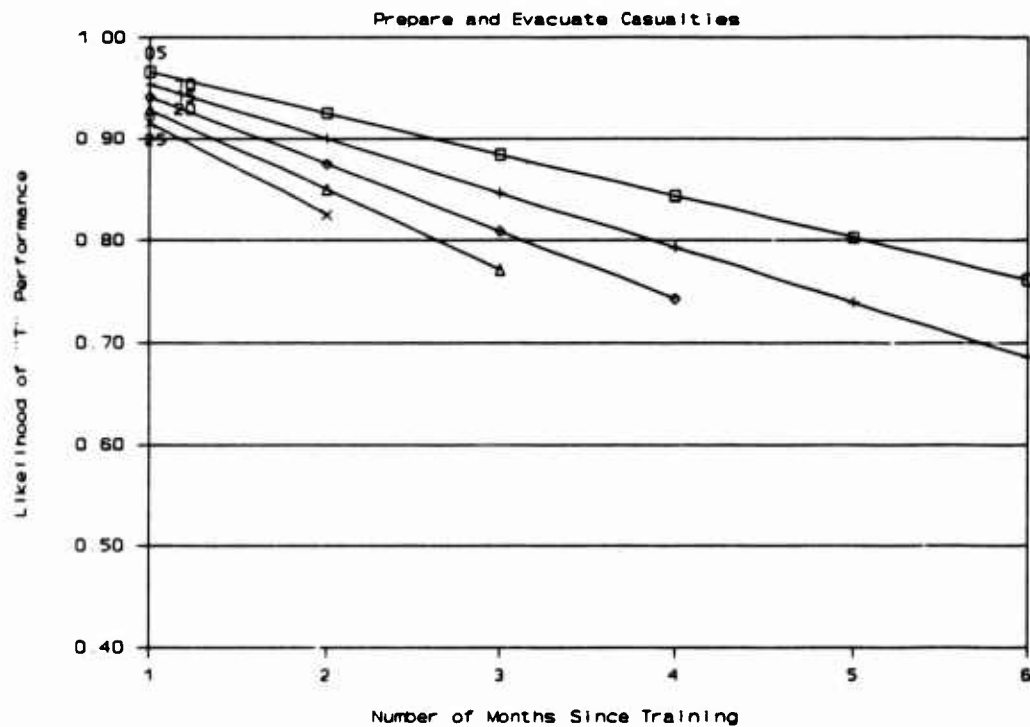
Armor Platoon Task



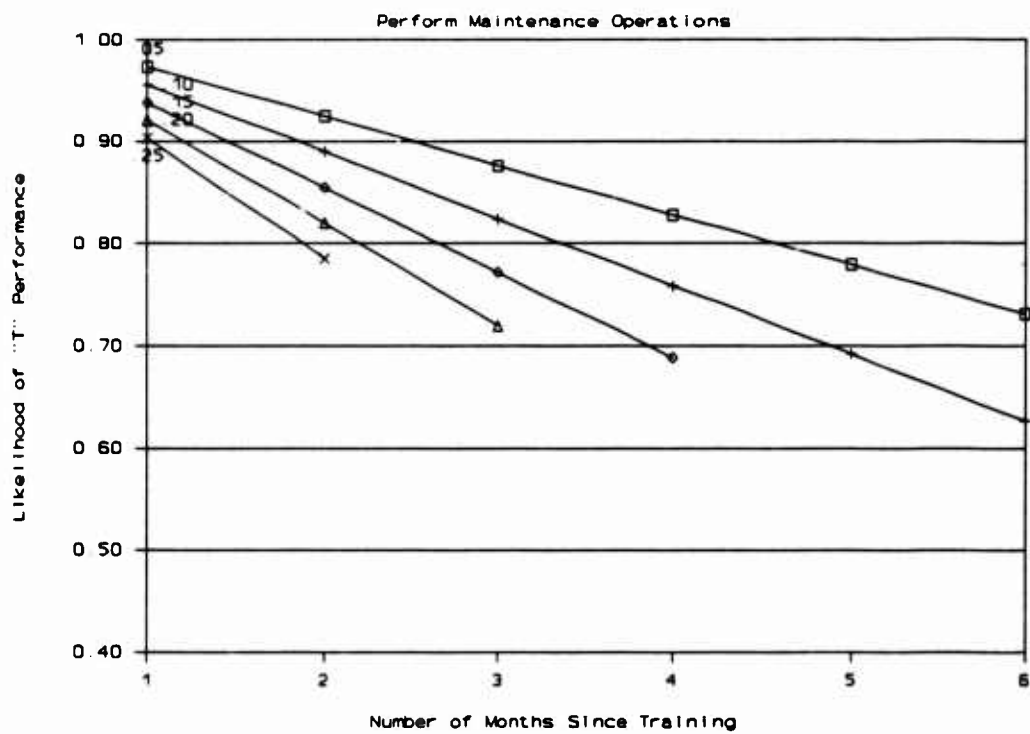
Armor Platoon Task



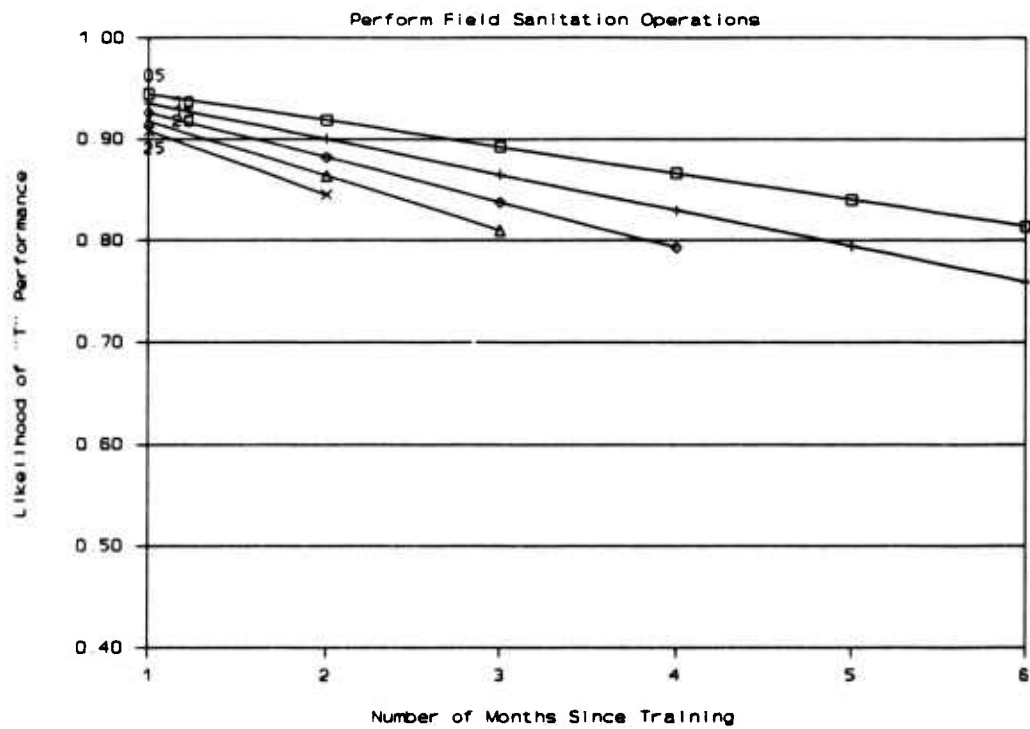
Armor Platoon Task



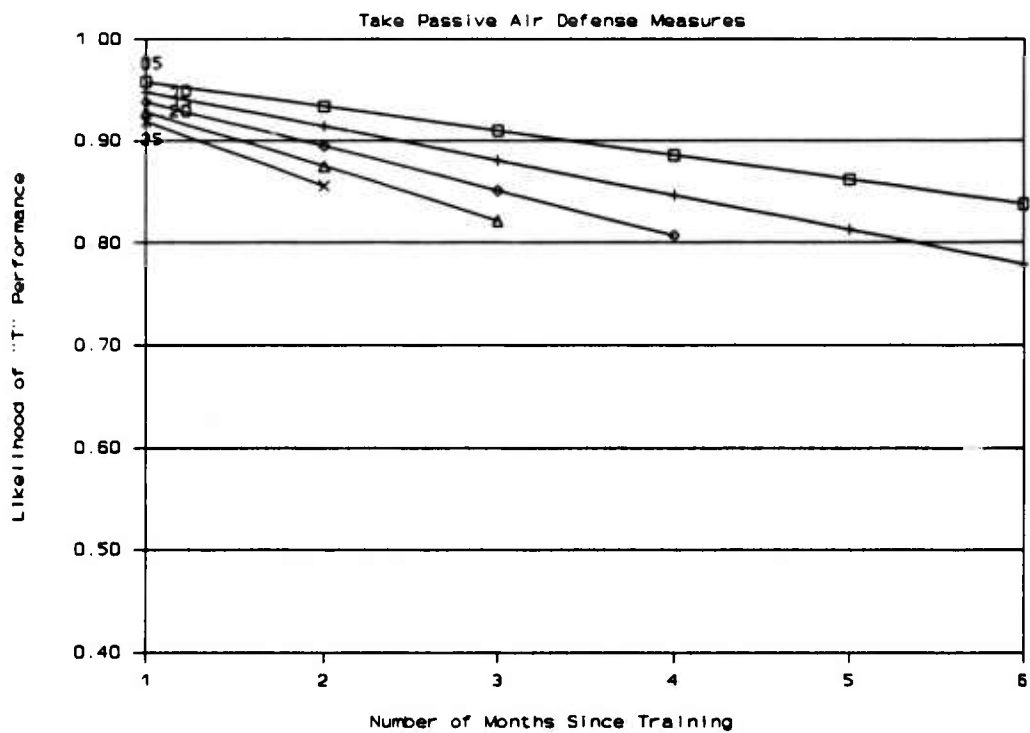
Armor Platoon Task



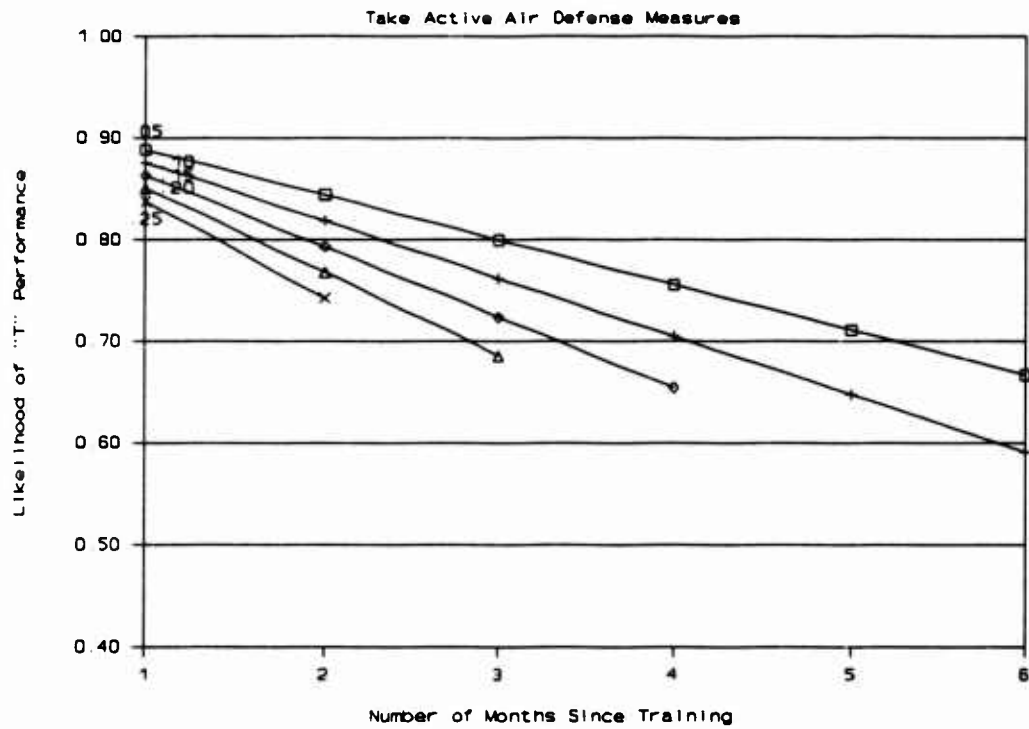
Armor Platoon Task



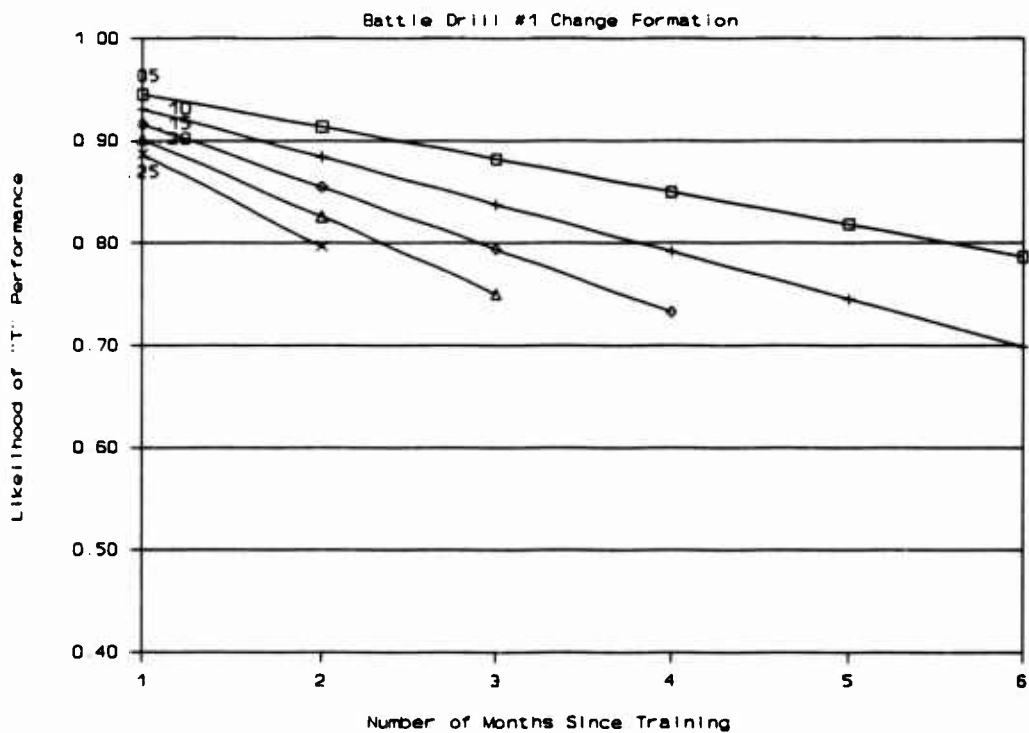
Armor Platoon Task



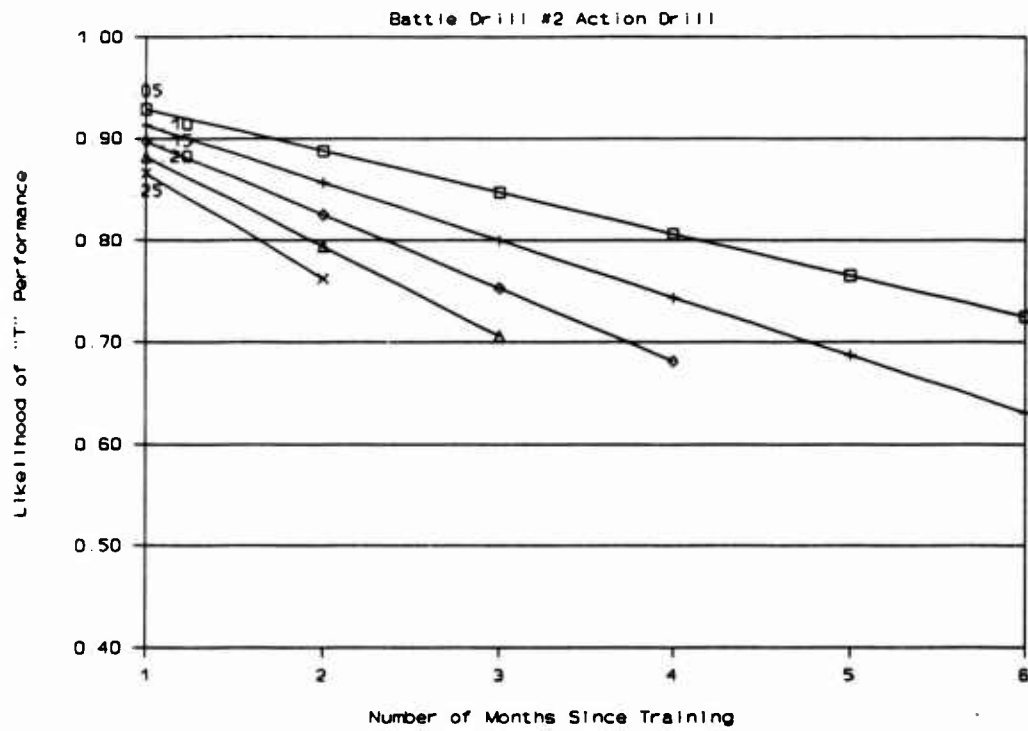
Armor Platoon Task



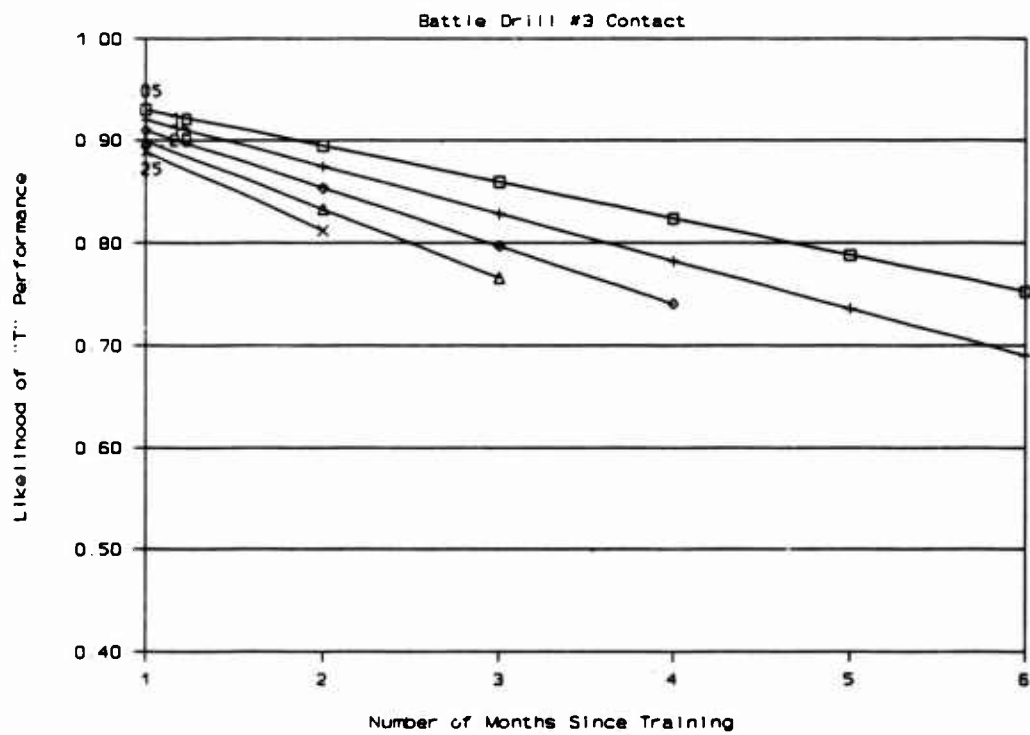
Armor Platoon Task



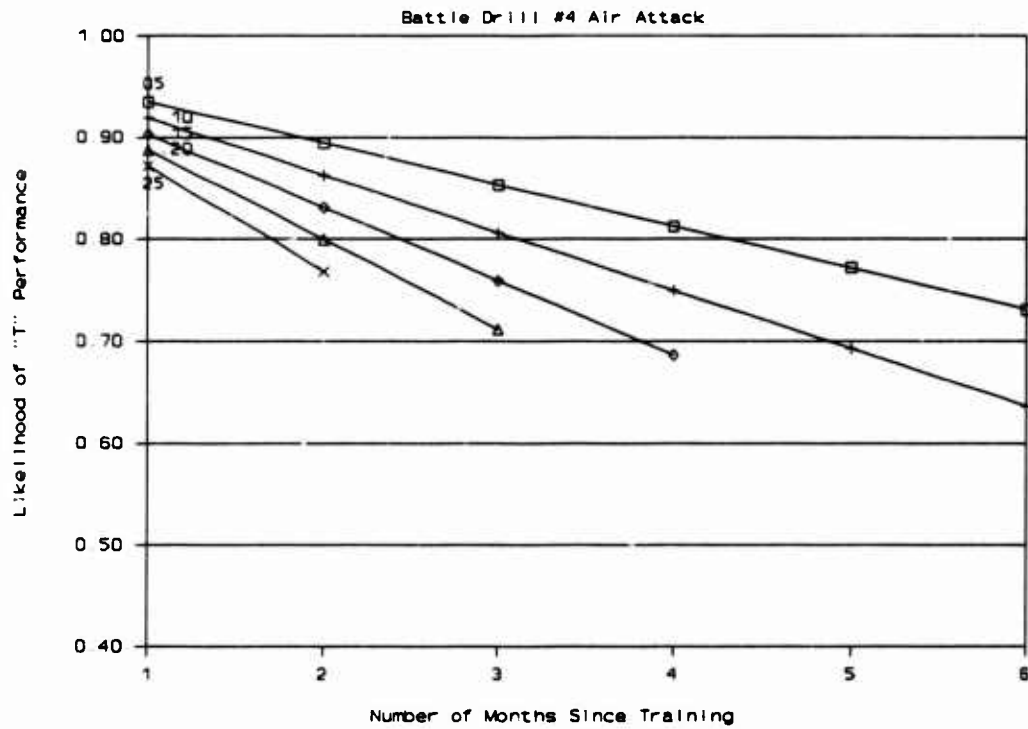
Armor Platoon Task



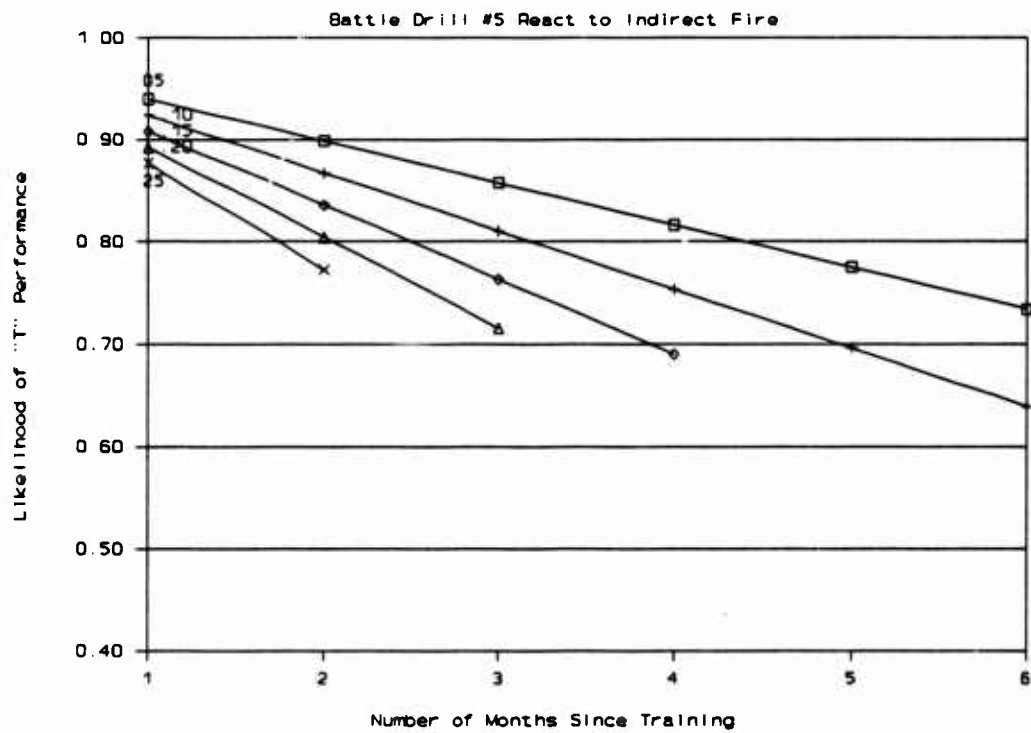
Armor Platoon Task



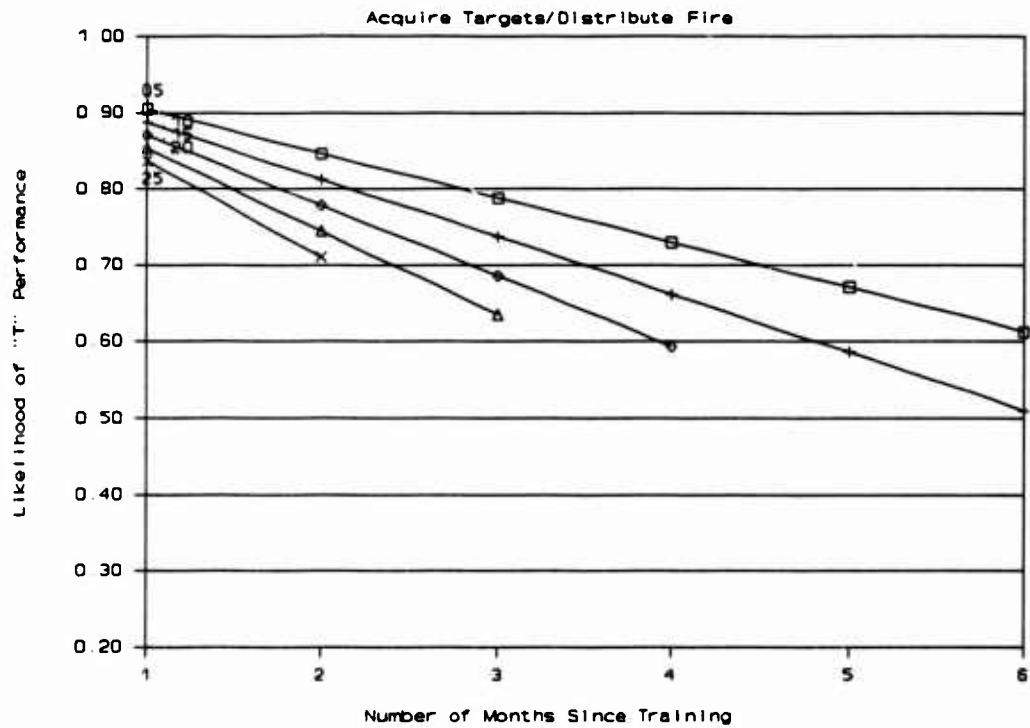
Armor Platoon Task



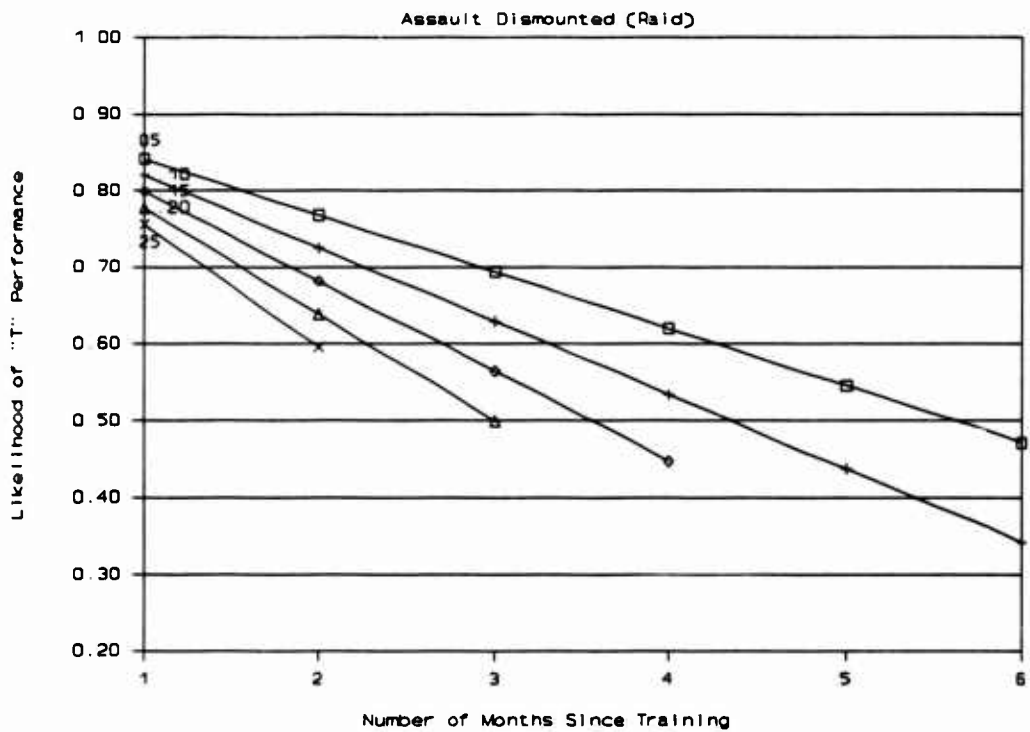
Armor Platoon Task



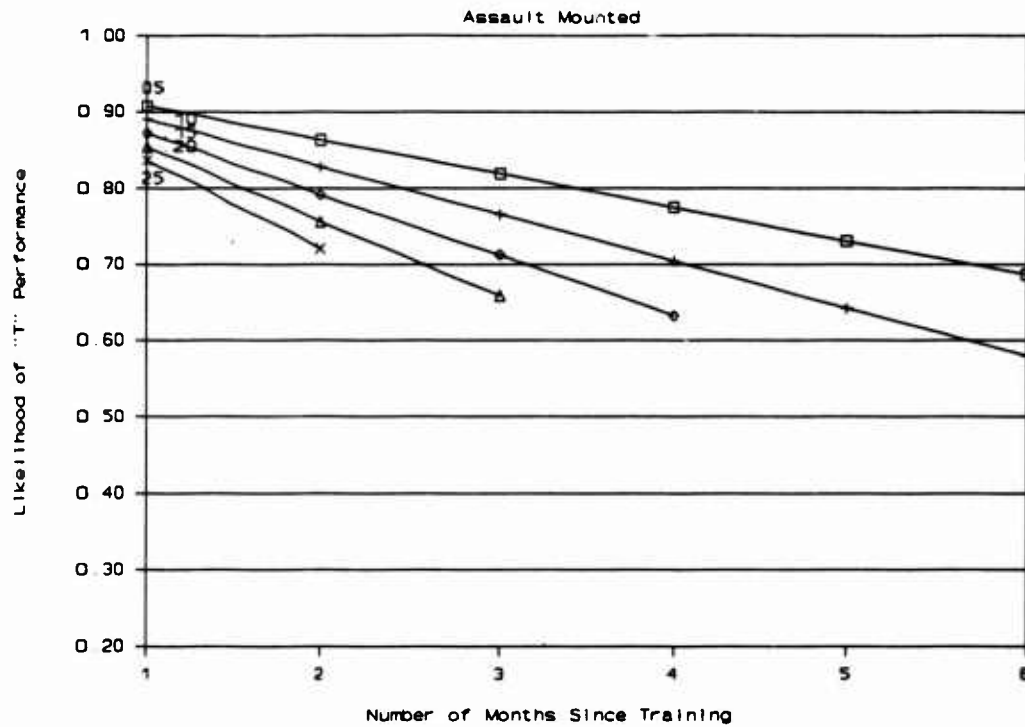
Mechanized Infantry Platoon Tasks



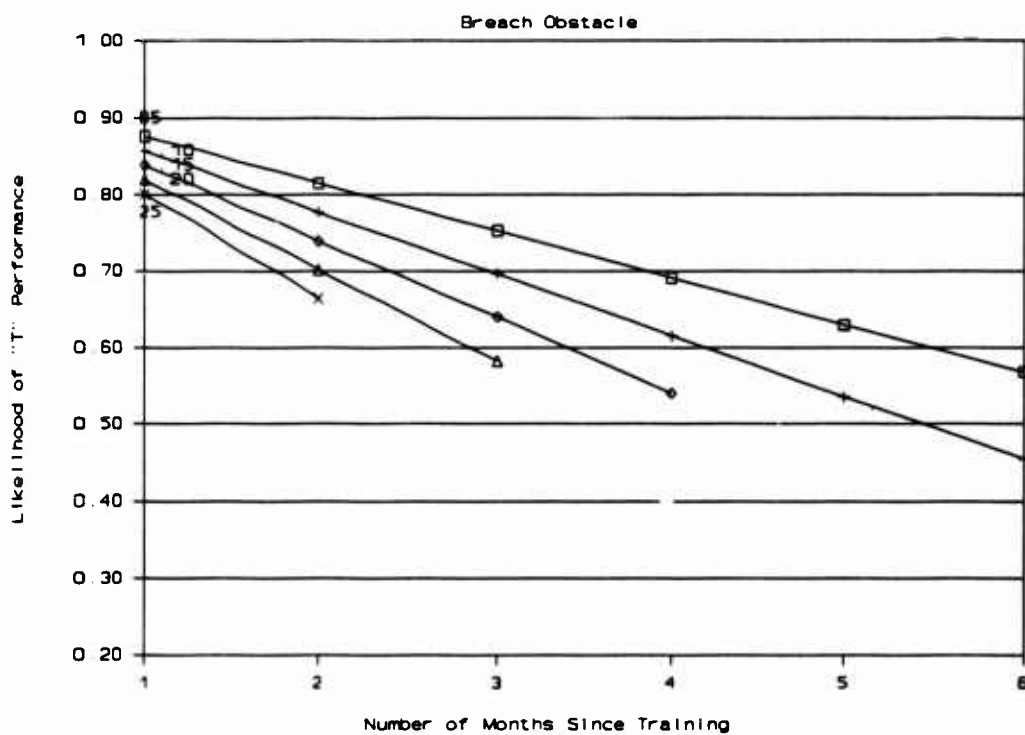
Mechanized Infantry Platoon Tasks



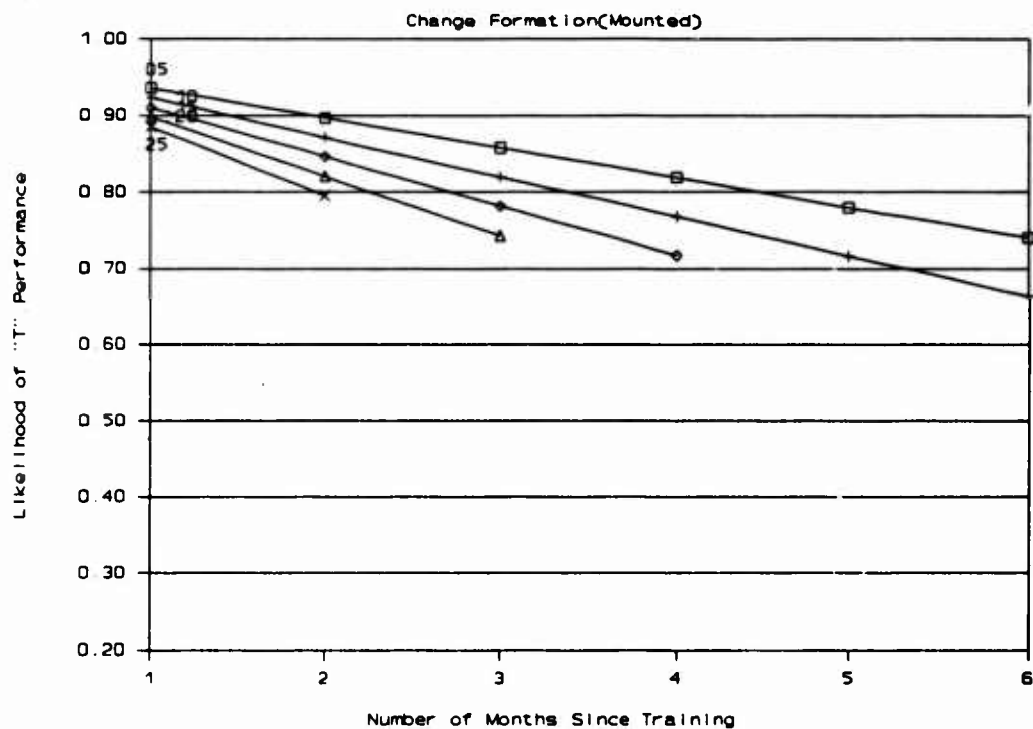
Mechanized Infantry Platoon Tasks



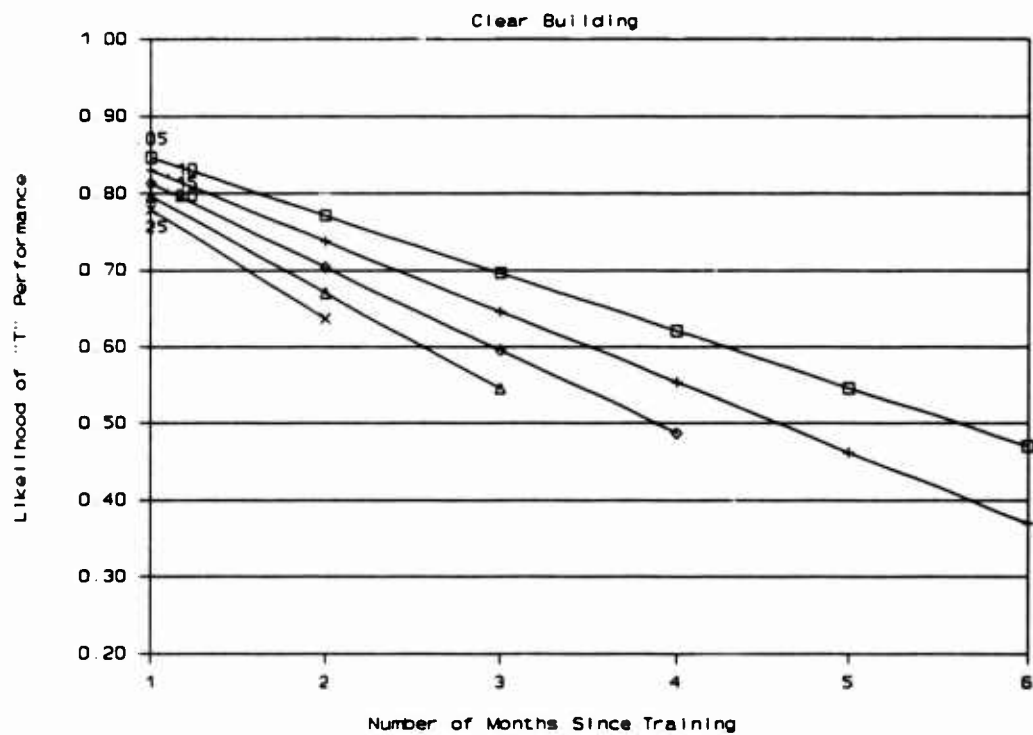
Mechanized Infantry Platoon Tasks



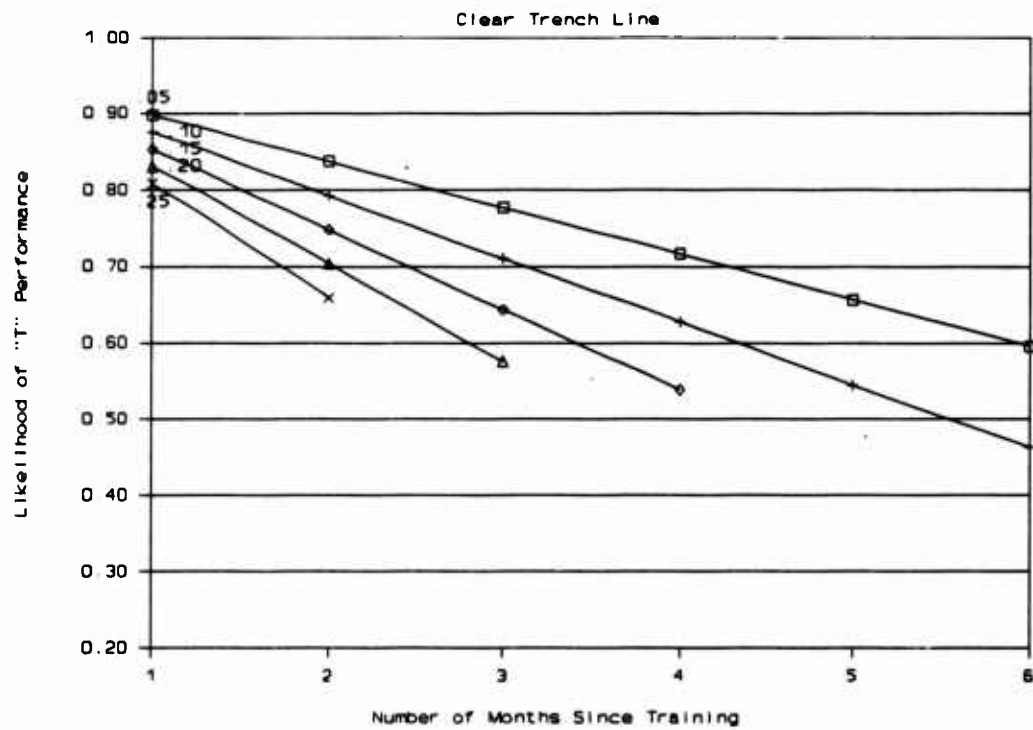
Mechanized Infantry Platoon Tasks



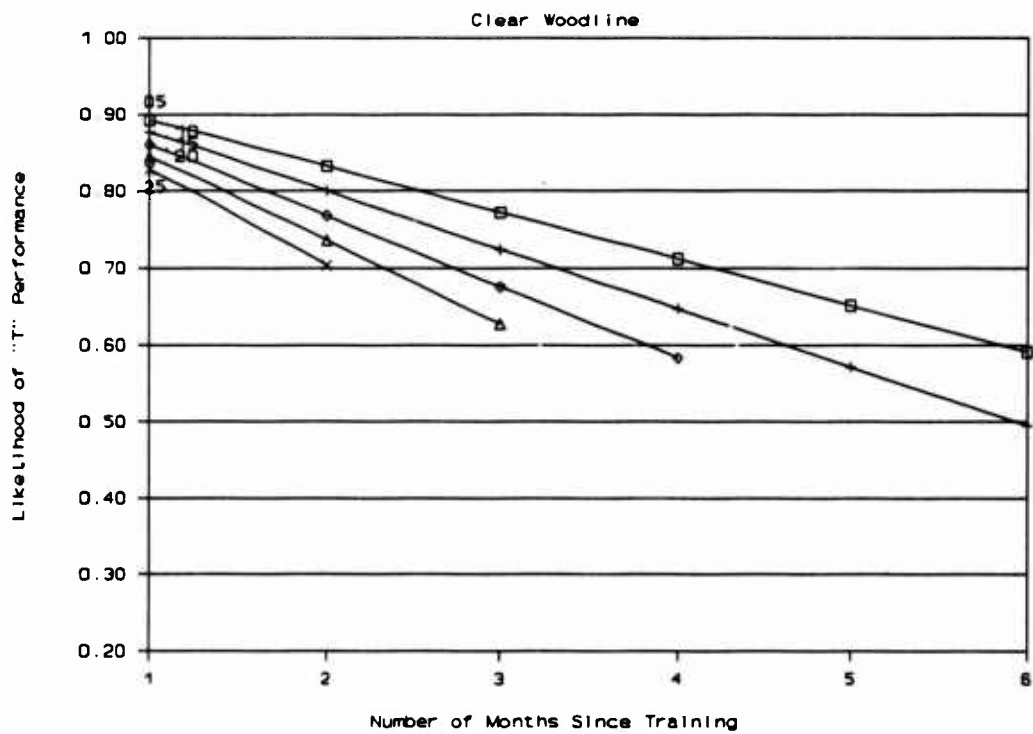
Mechanized Infantry Platoon Tasks



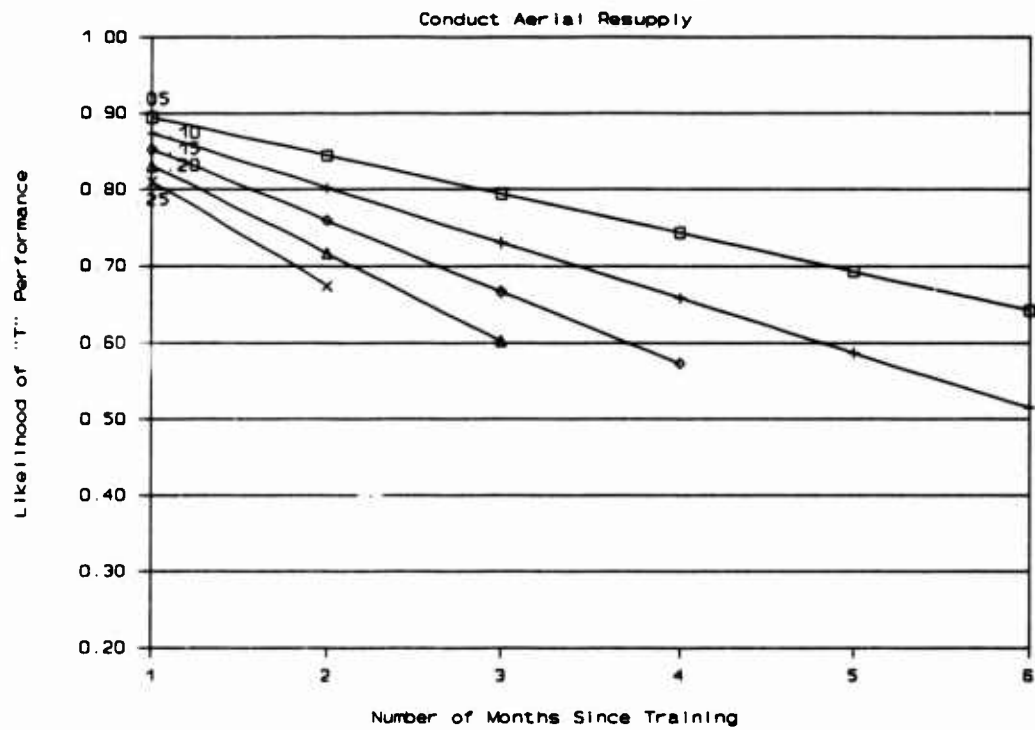
Mechanized Infantry Platoon Tasks



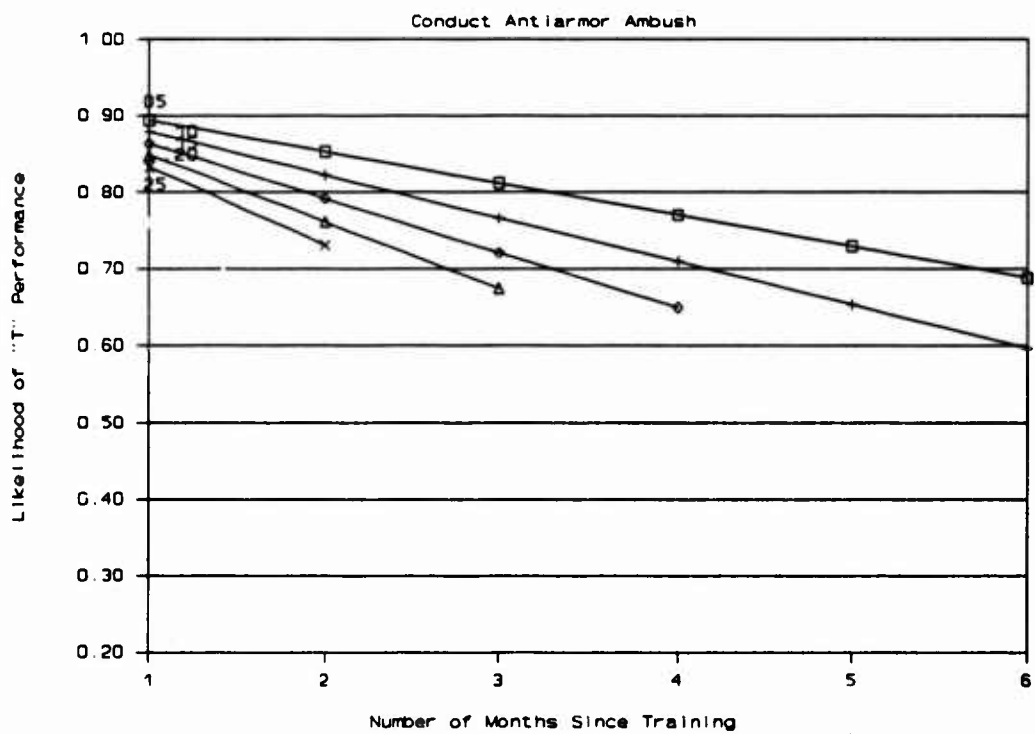
Mechanized Infantry Platoon Tasks



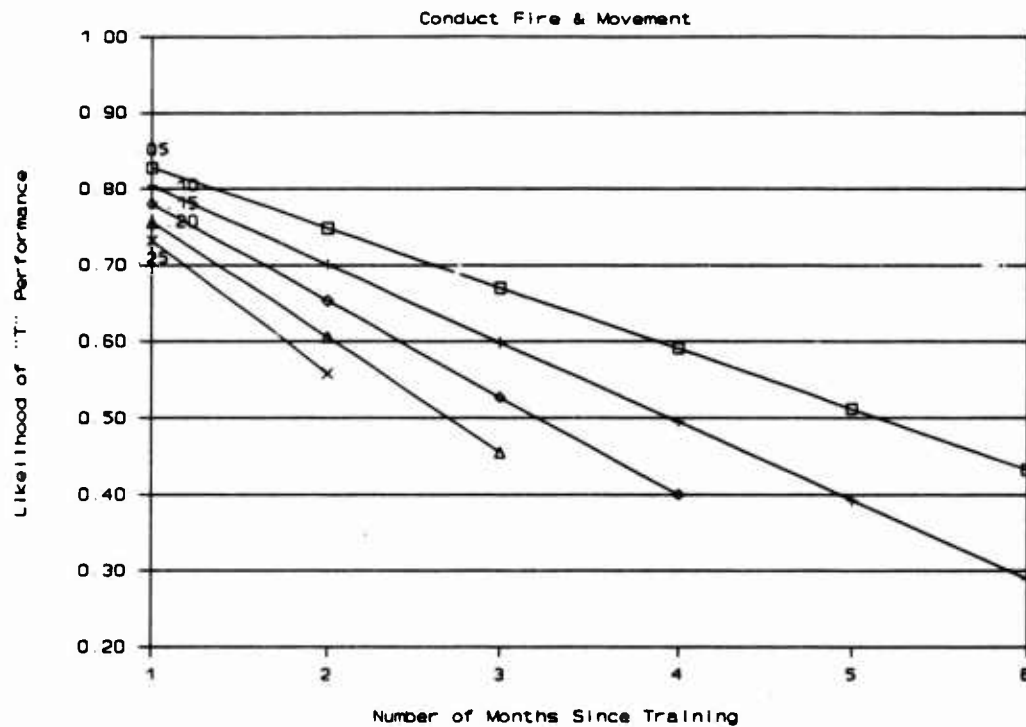
Mechanized Infantry Platoon Tasks



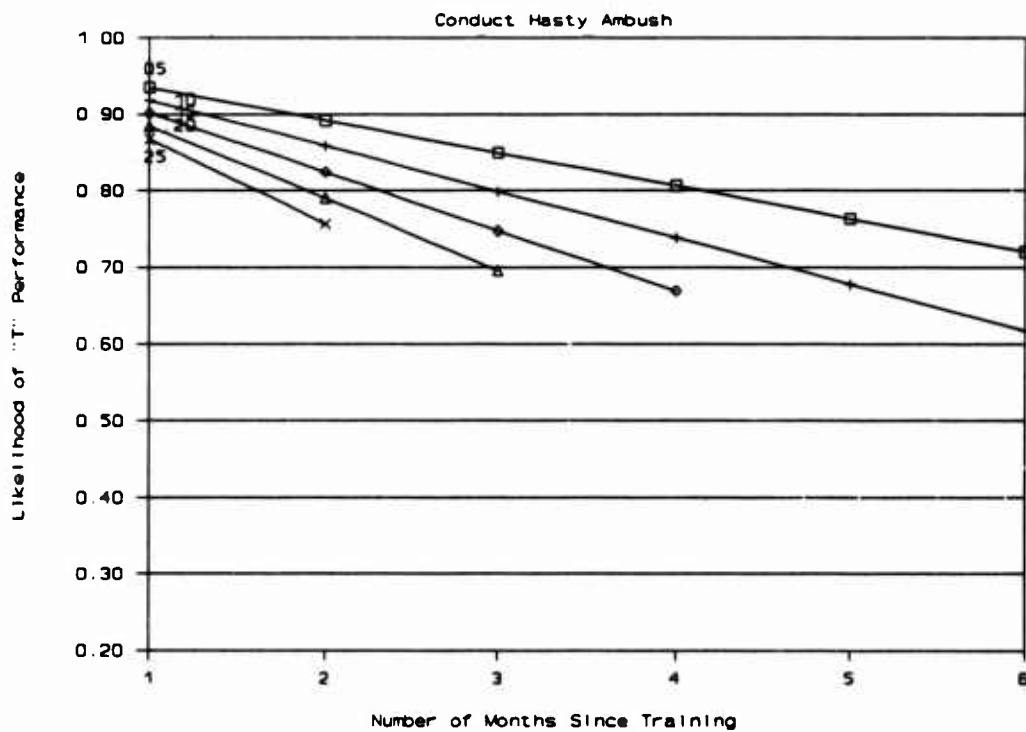
Mechanized Infantry Platoon Tasks



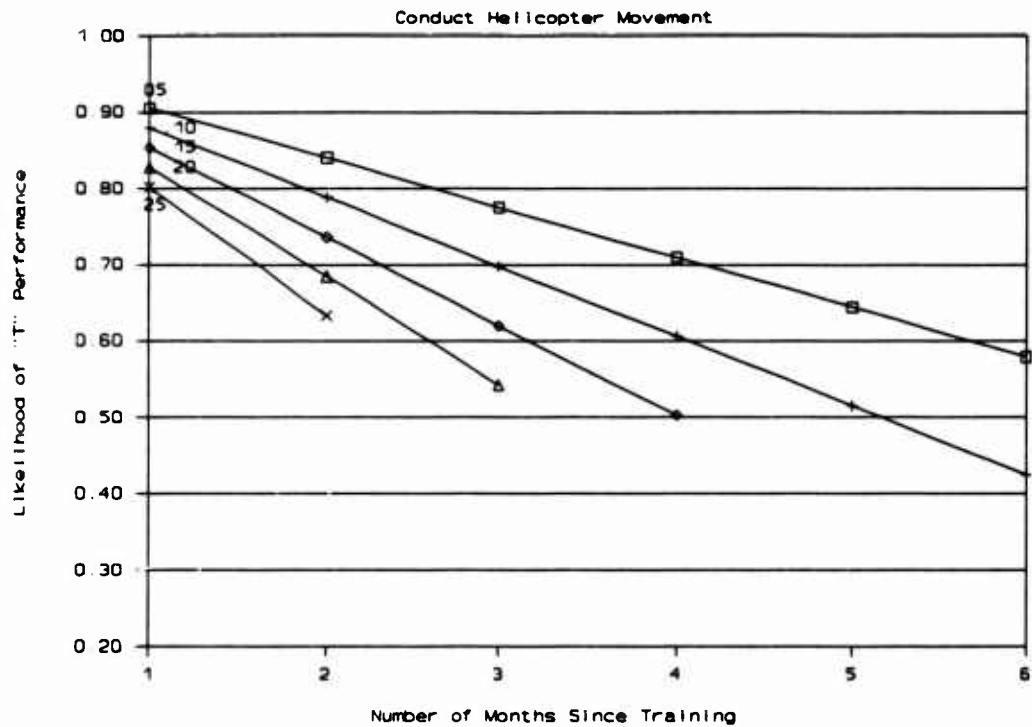
Mechanized Infantry Platoon Tasks



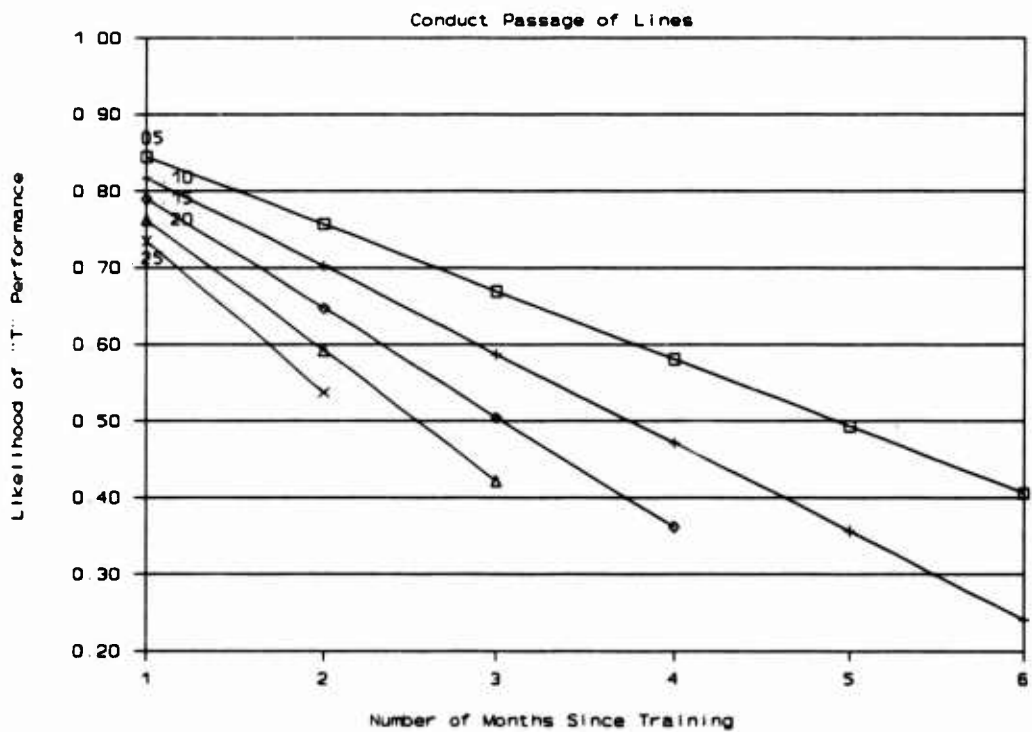
Mechanized Infantry Platoon Tasks



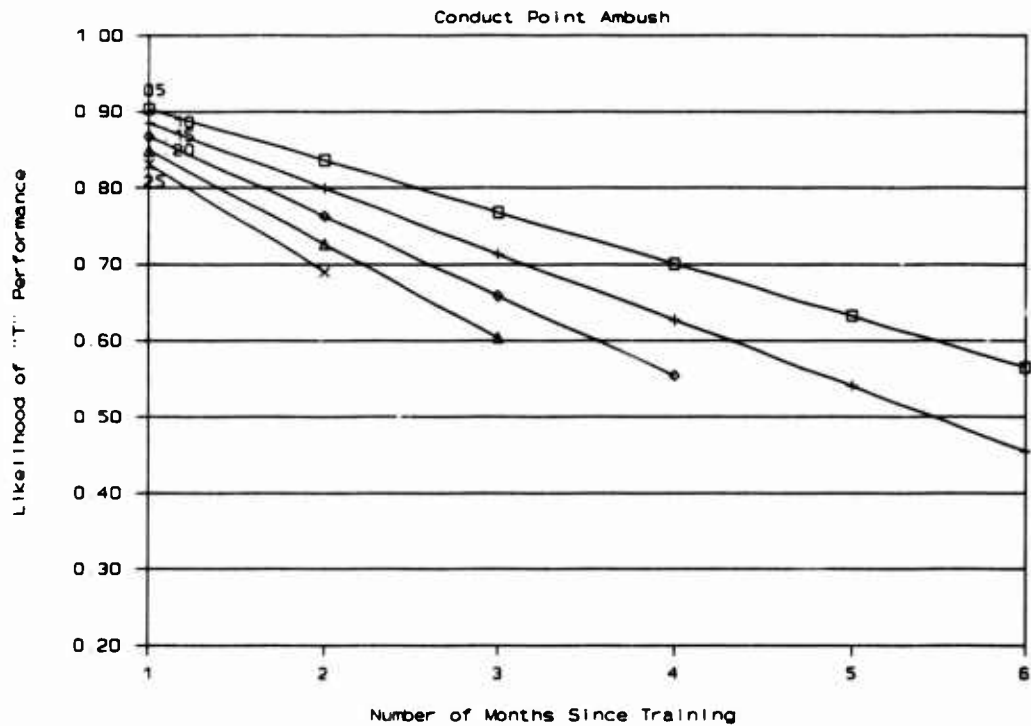
Mechanized Infantry Platoon Tasks



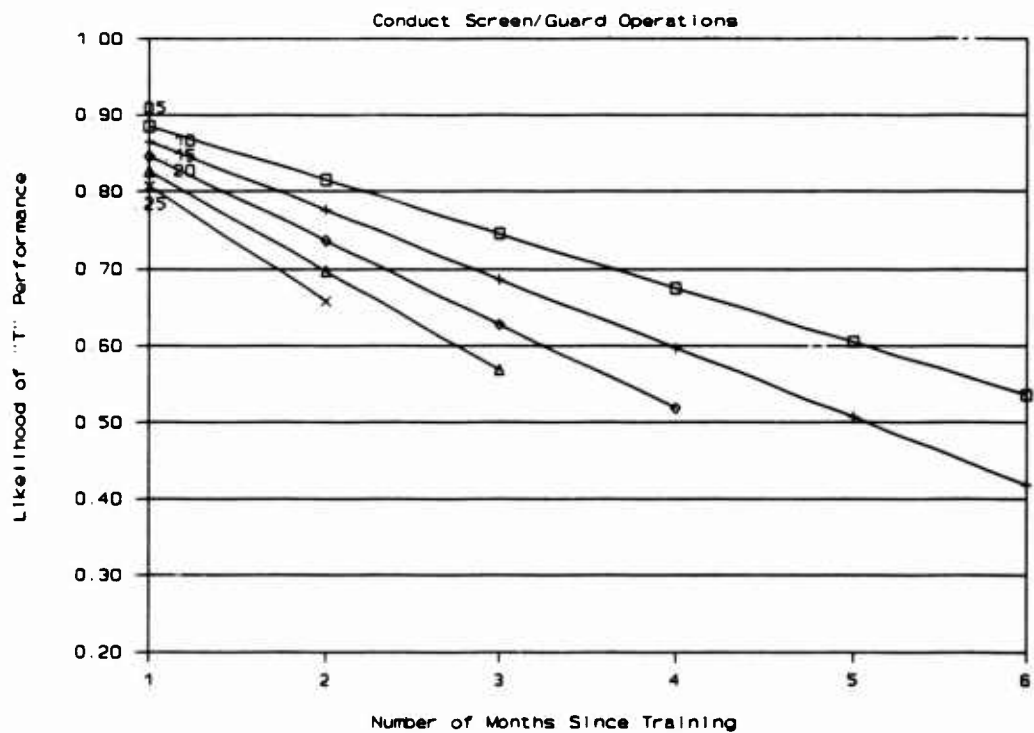
Mechanized Infantry Platoon Tasks



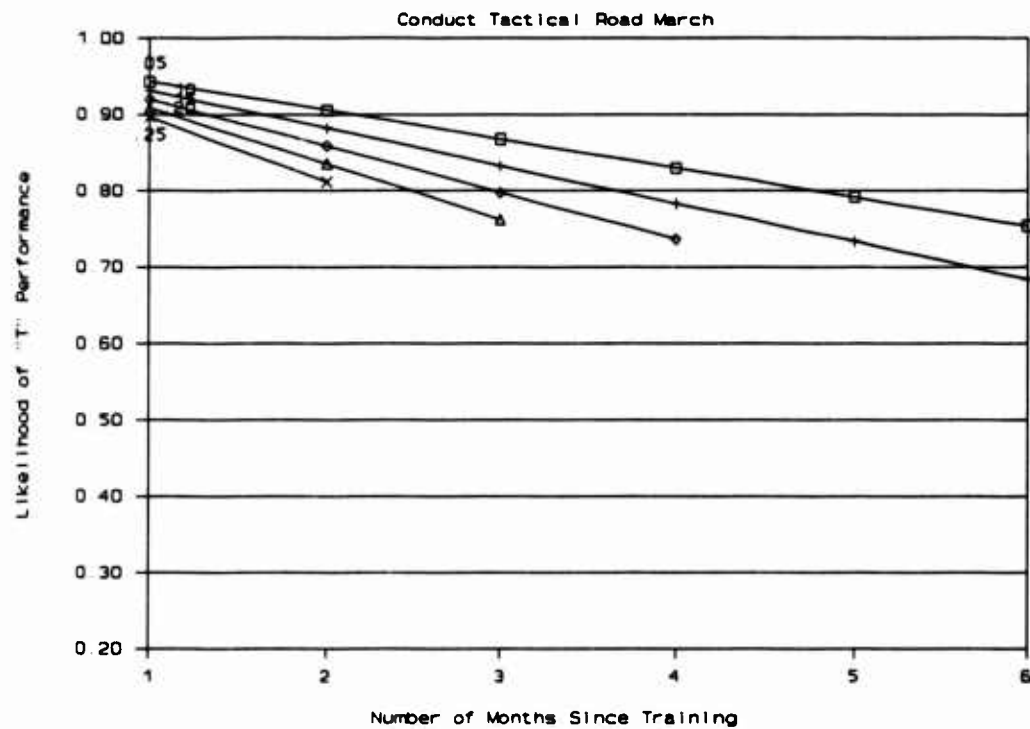
Mechanized Infantry Platoon Tasks



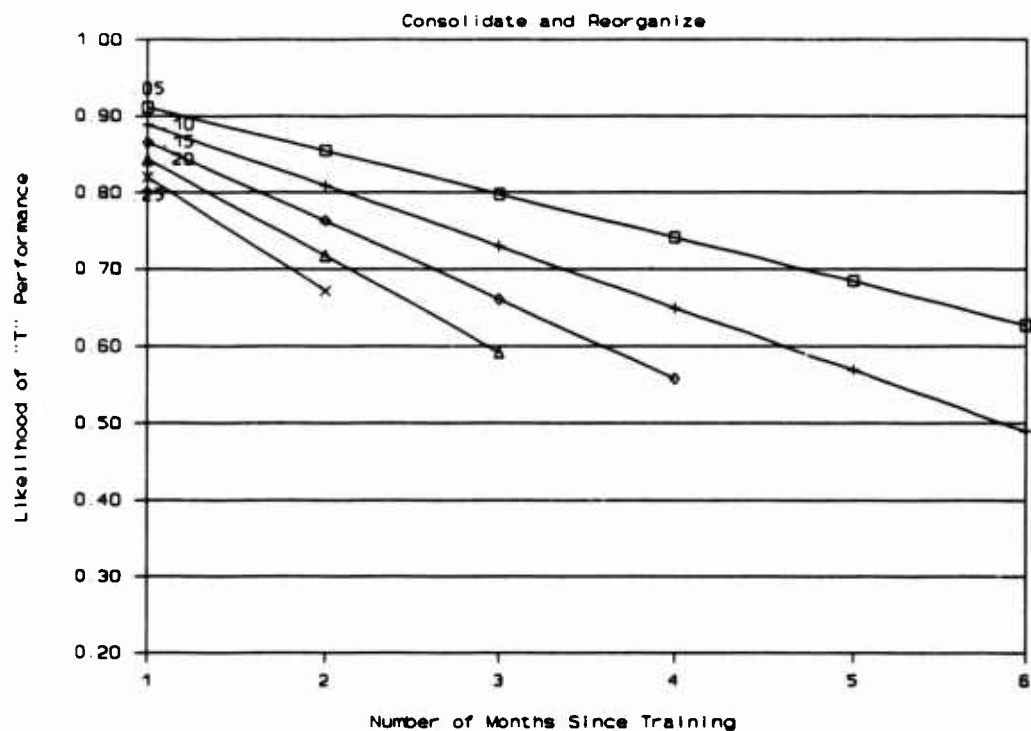
Mechanized Infantry Platoon Tasks



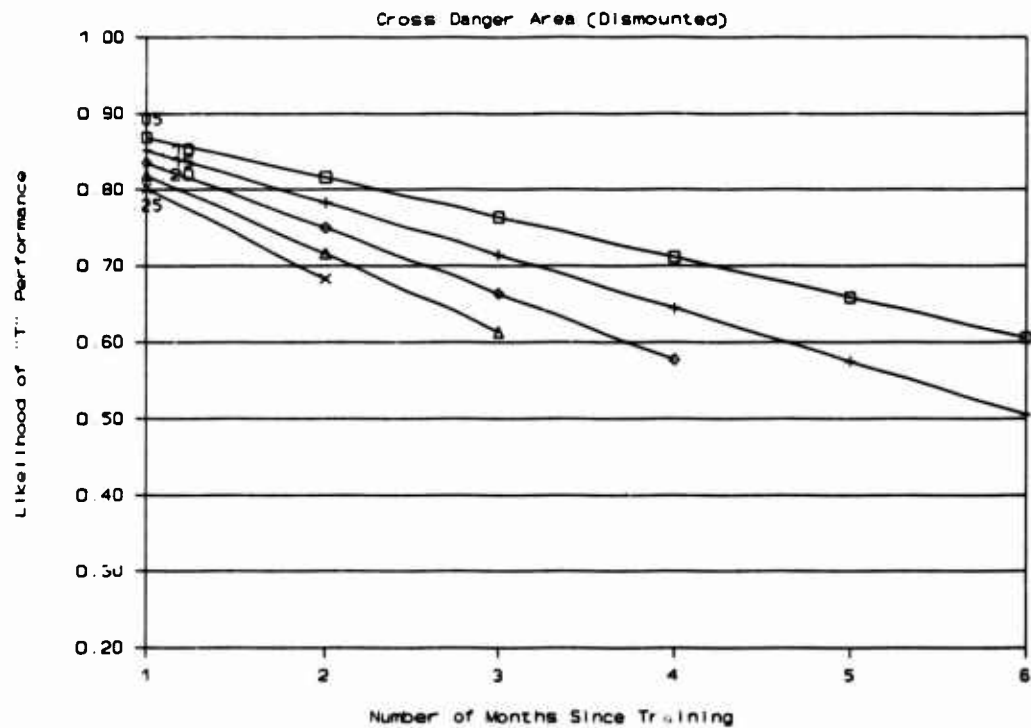
Mechanized Infantry Platoon Tasks



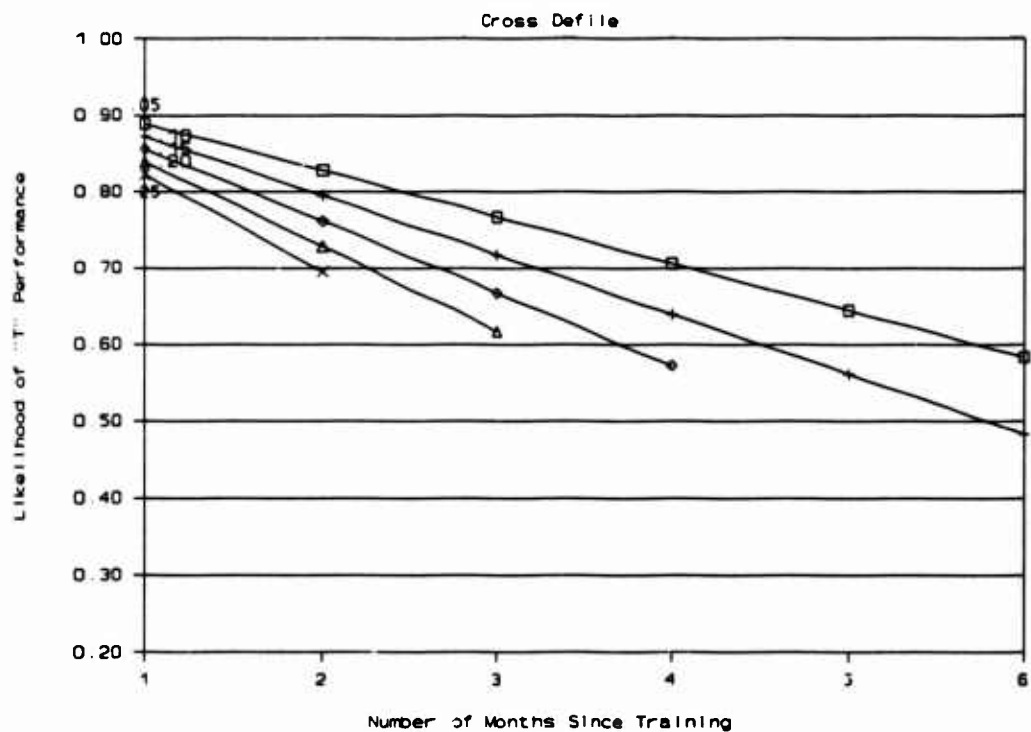
Mechanized Infantry Platoon Tasks



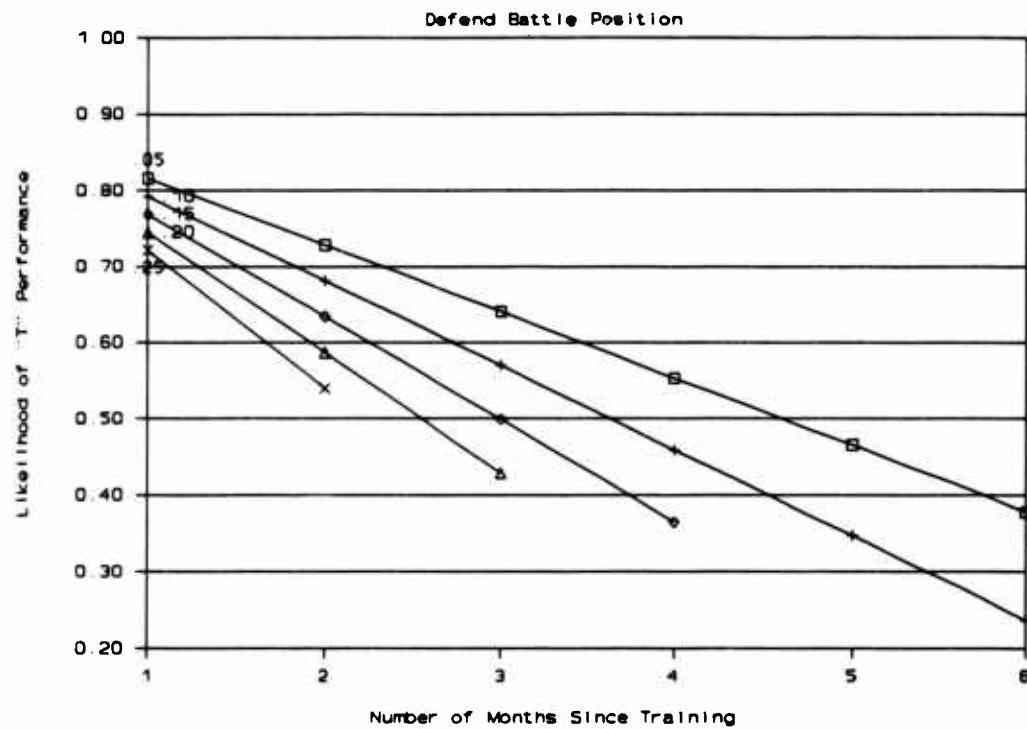
Mechanized Infantry Platoon Tasks



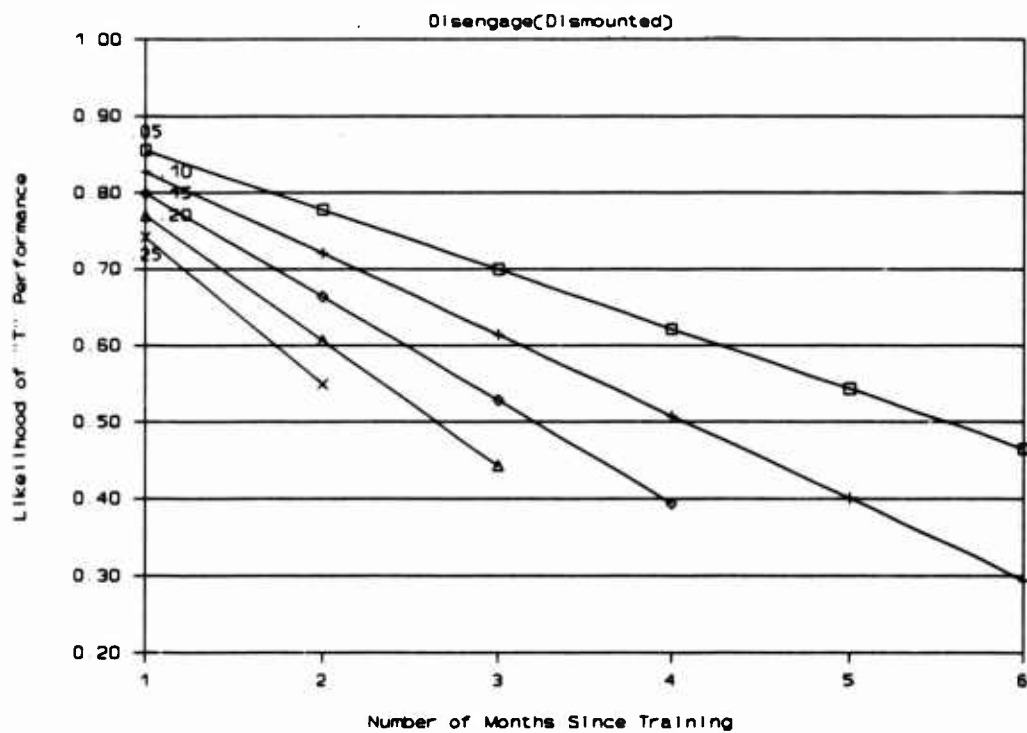
Mechanized Infantry Platoon Tasks



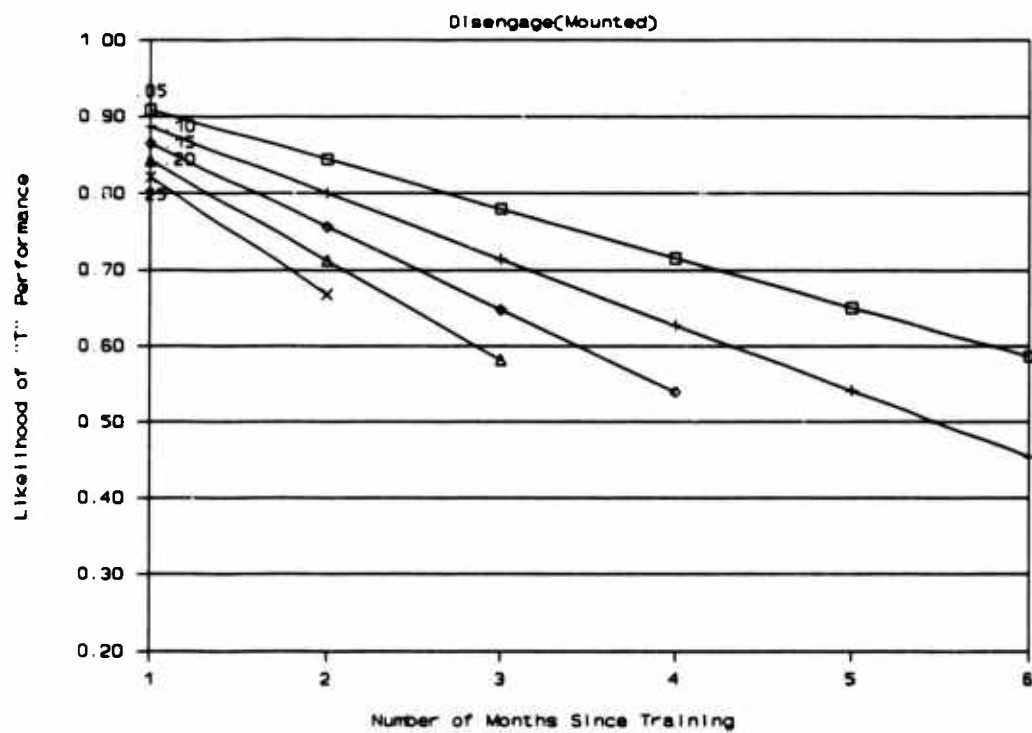
Mechanized Infantry Platoon Tasks



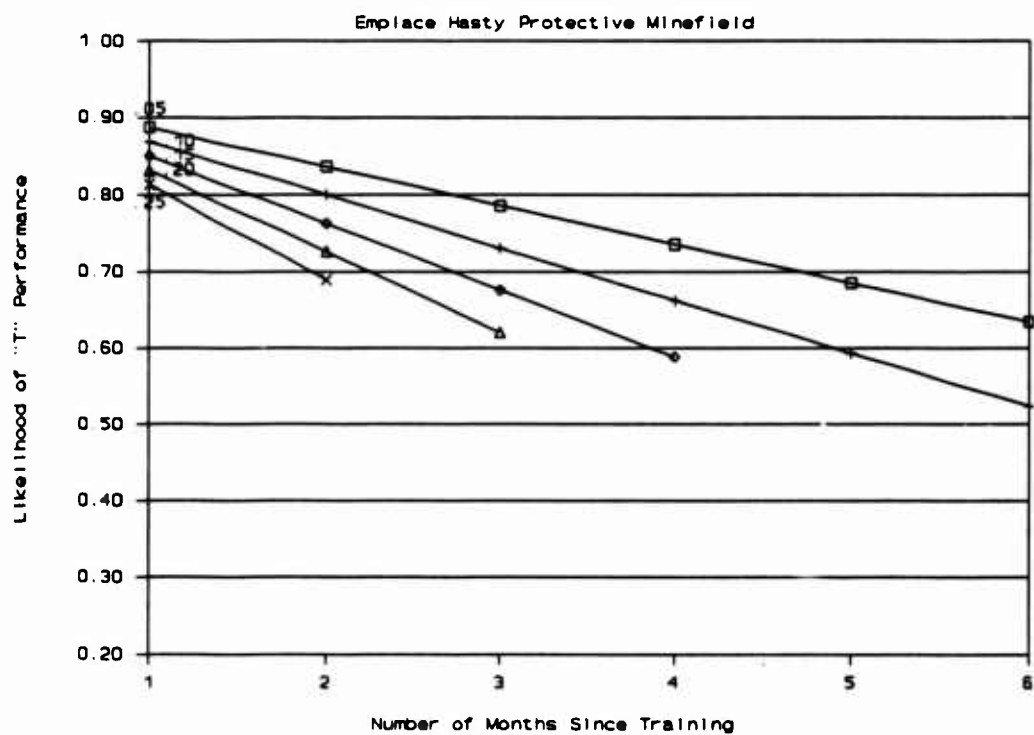
Mechanized Infantry Platoon Tasks



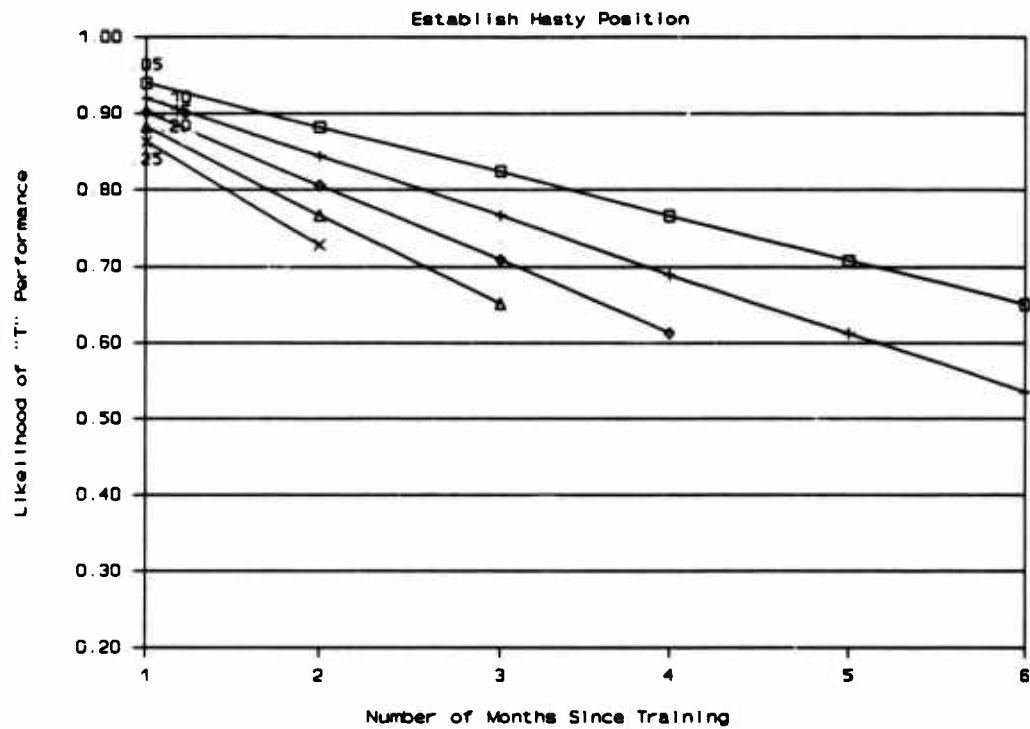
Mechanized Infantry Platoon Tasks



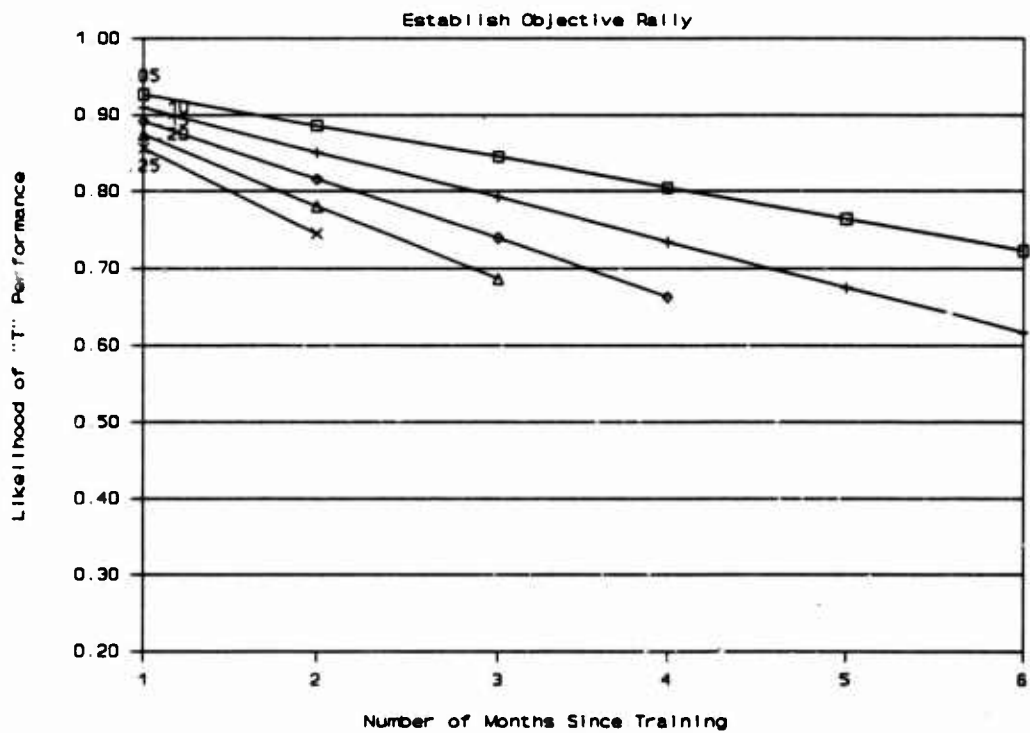
Mechanized Infantry Platoon Tasks



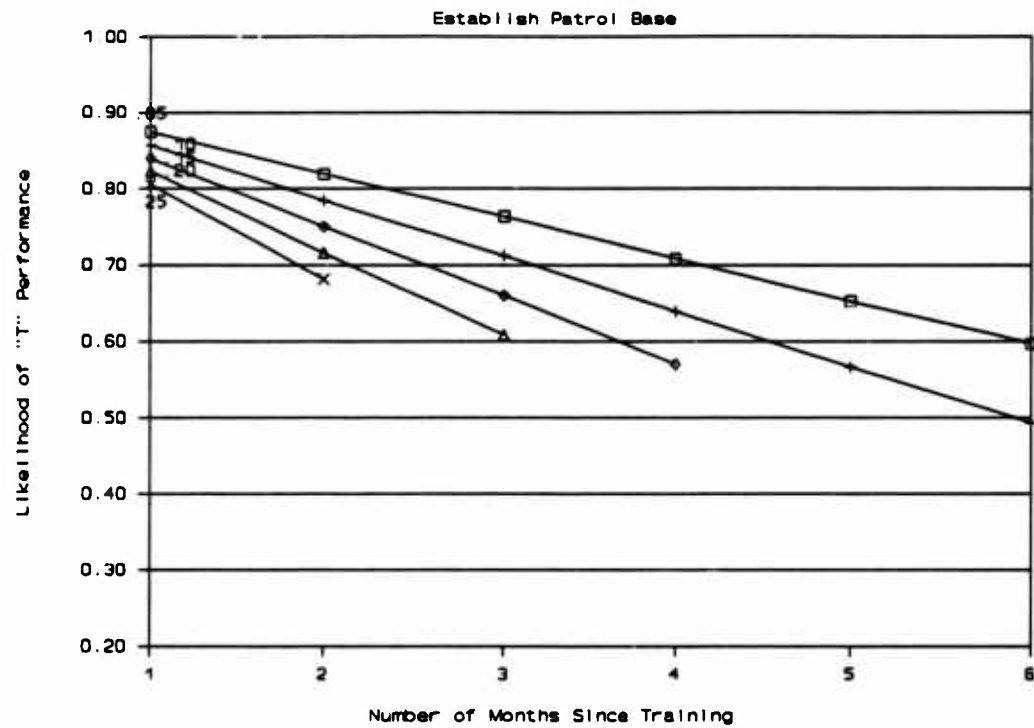
Mechanized Infantry Platoon Tasks



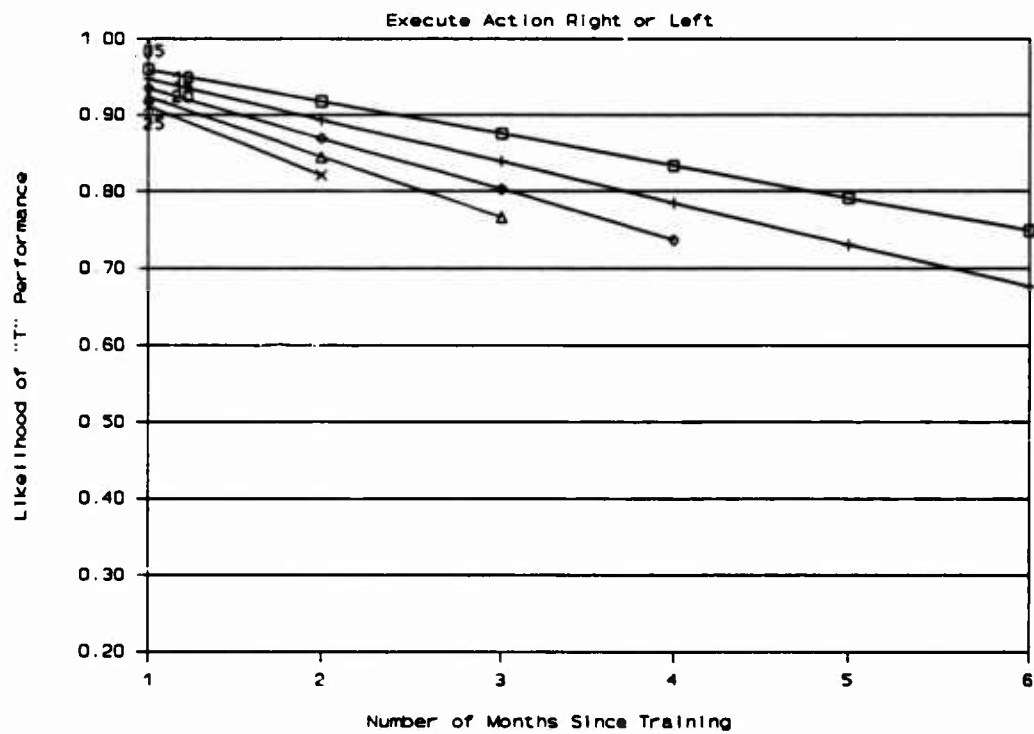
Mechanized Infantry Platoon Tasks



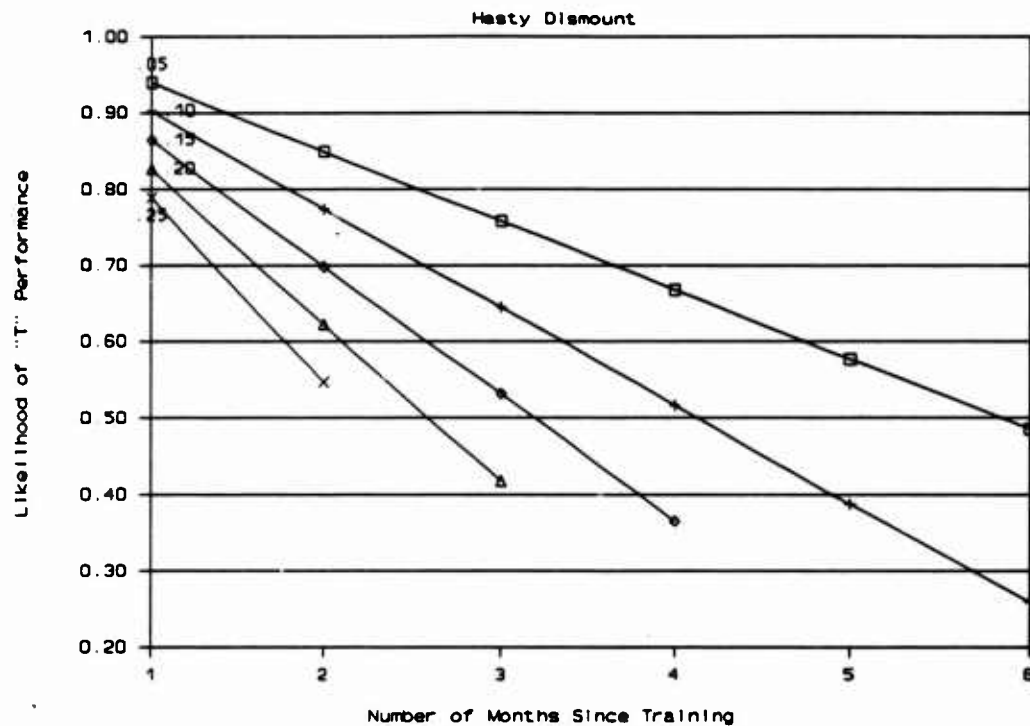
Mechanized Infantry Platoon Tasks



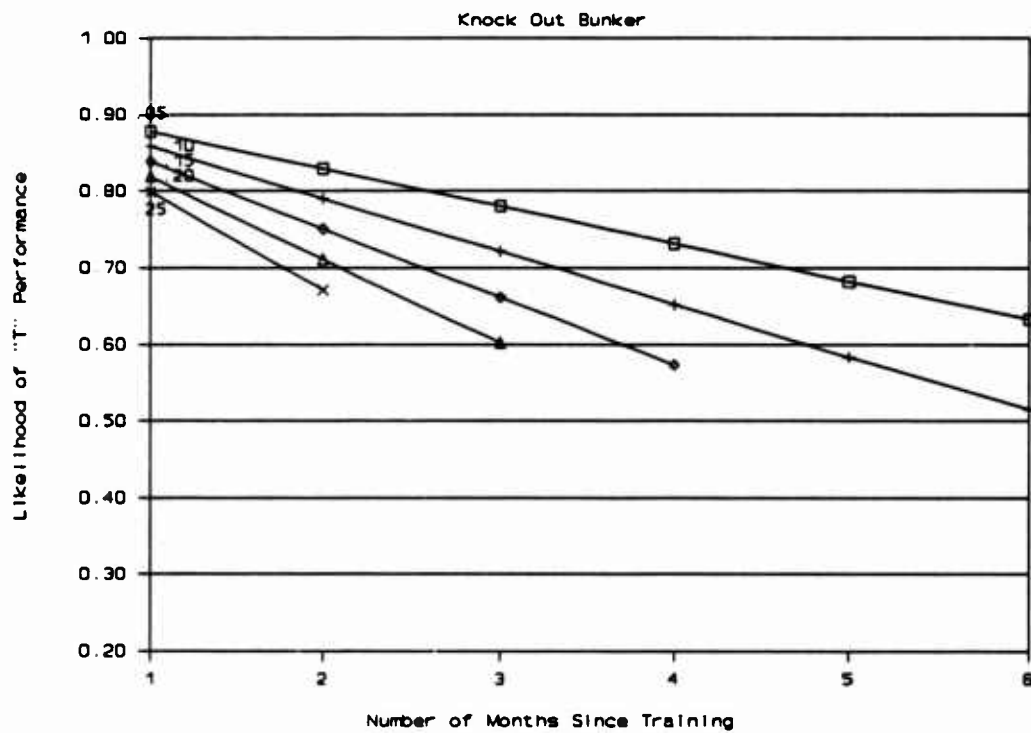
Mechanized Infantry Platoon Tasks



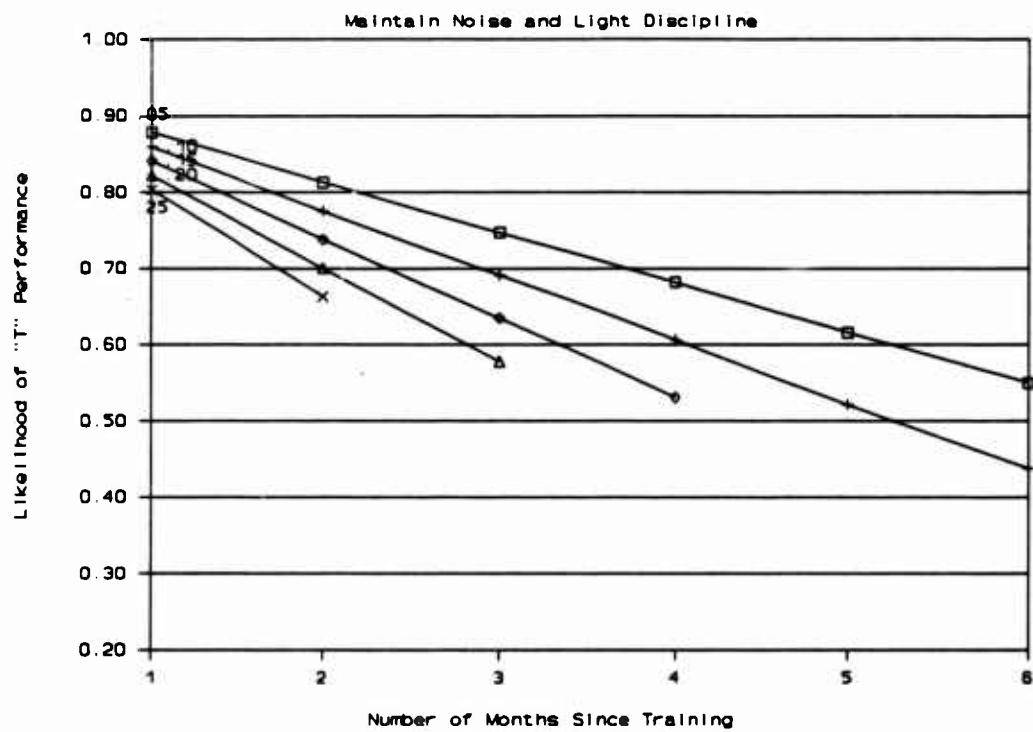
Mechanized Infantry Platoon Tasks



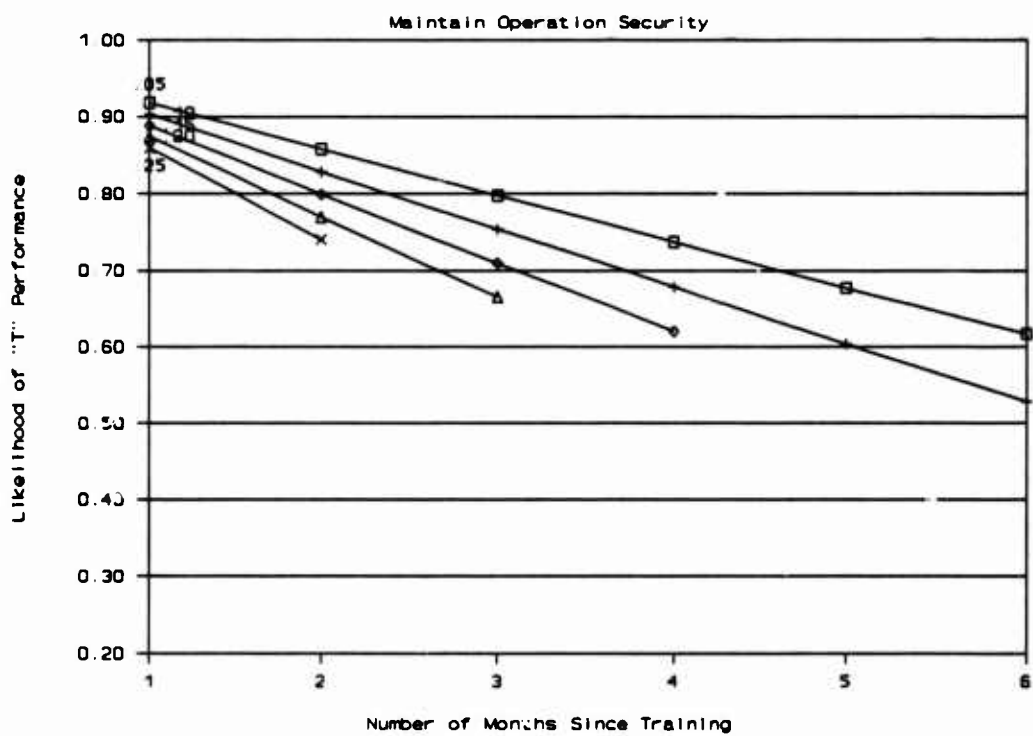
Mechanized Infantry Platoon Tasks



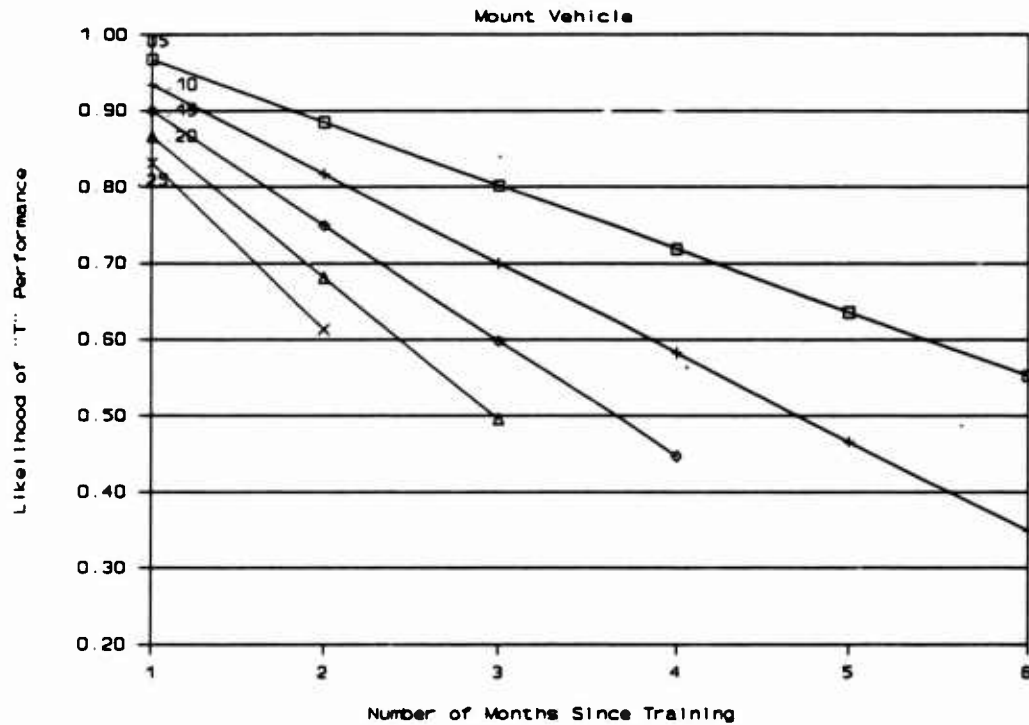
Mechanized Infantry Platoon Tasks



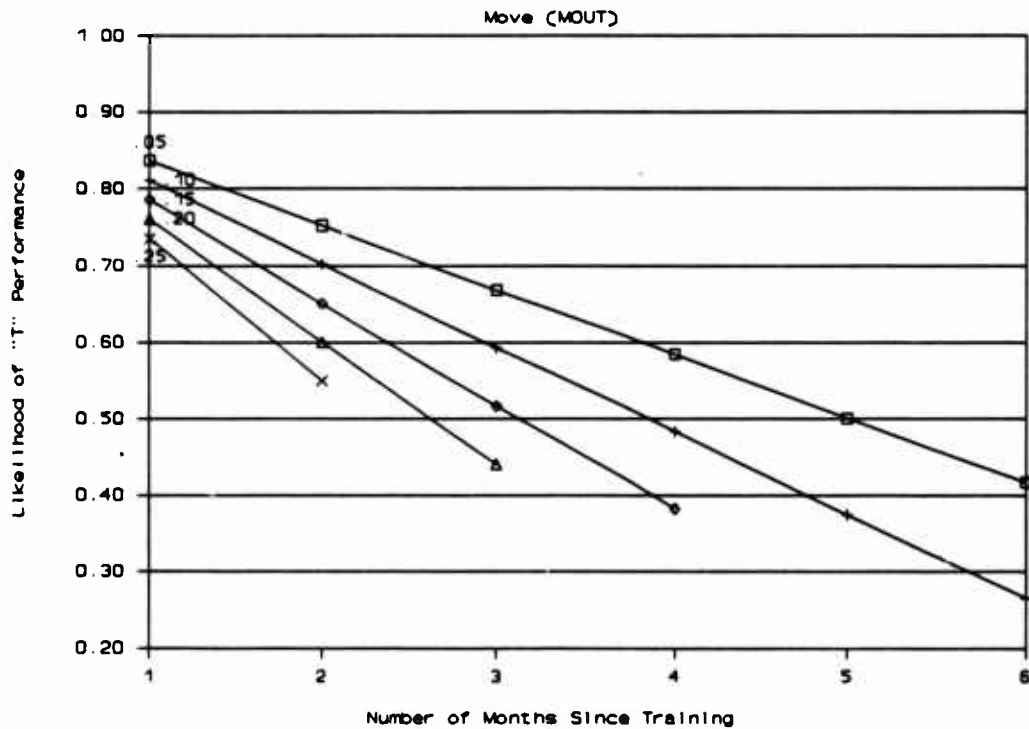
Mechanized Infantry Platoon Tasks



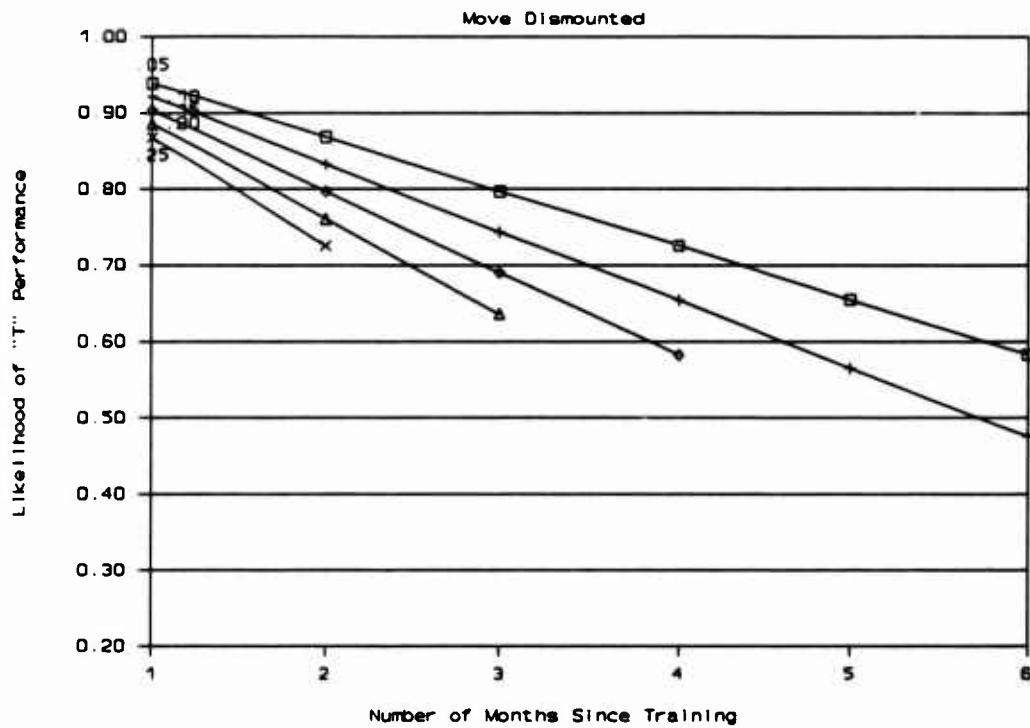
Mechanized Infantry Platoon Tasks



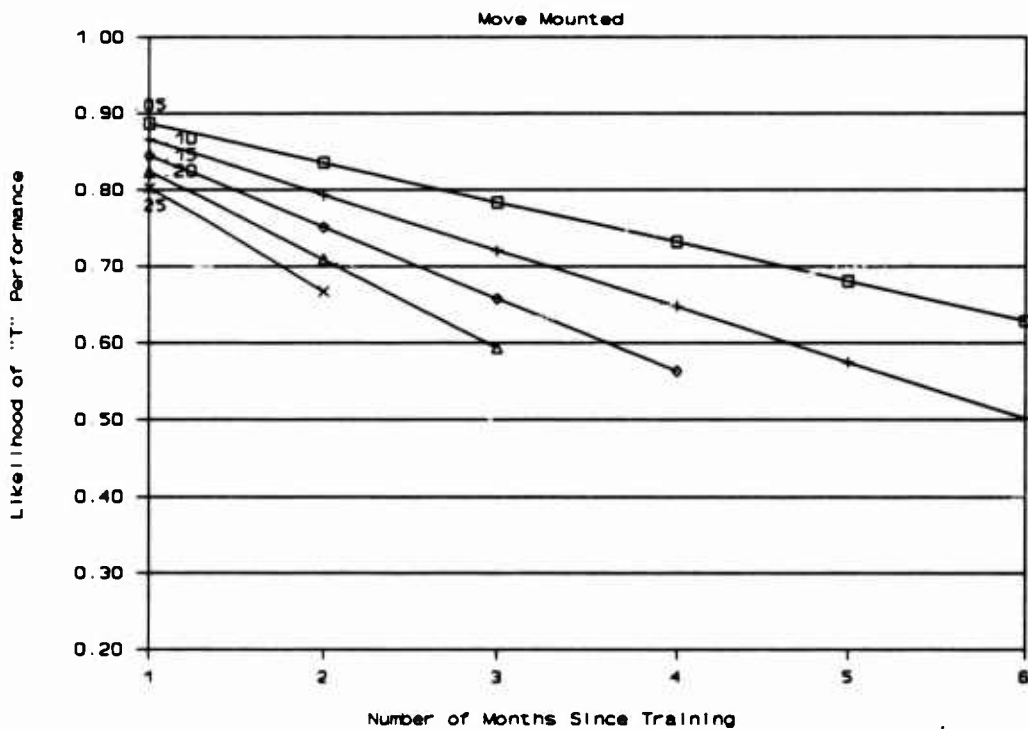
Mechanized Infantry Platoon Tasks



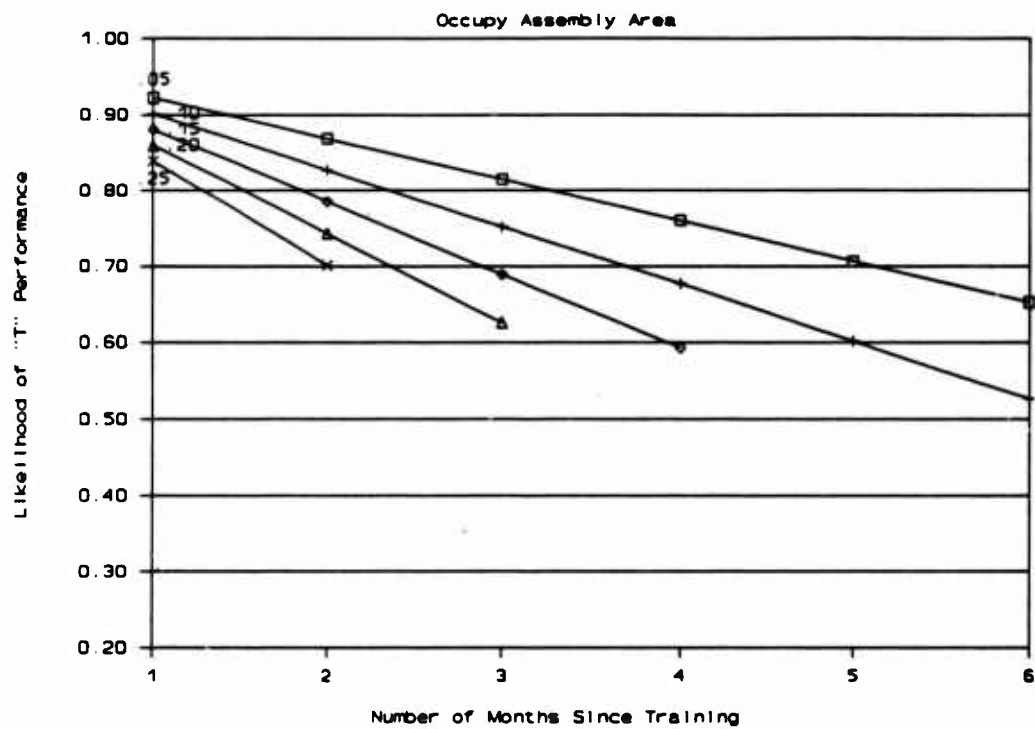
Mechanized Infantry Platoon Tasks



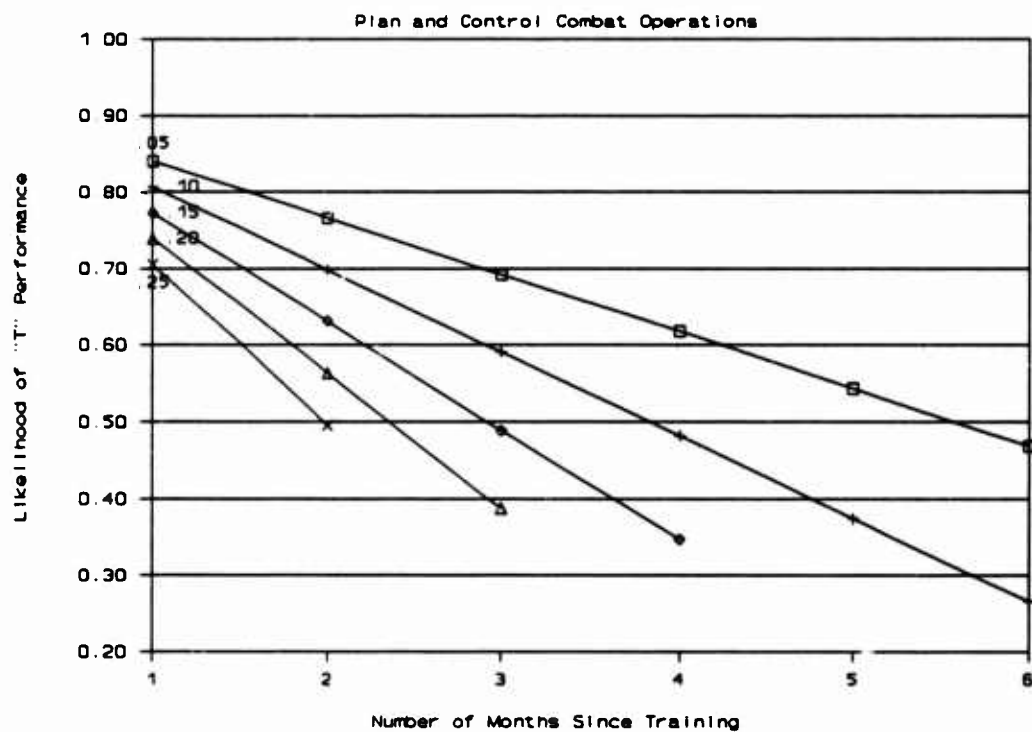
Mechanized Infantry Platoon Tasks



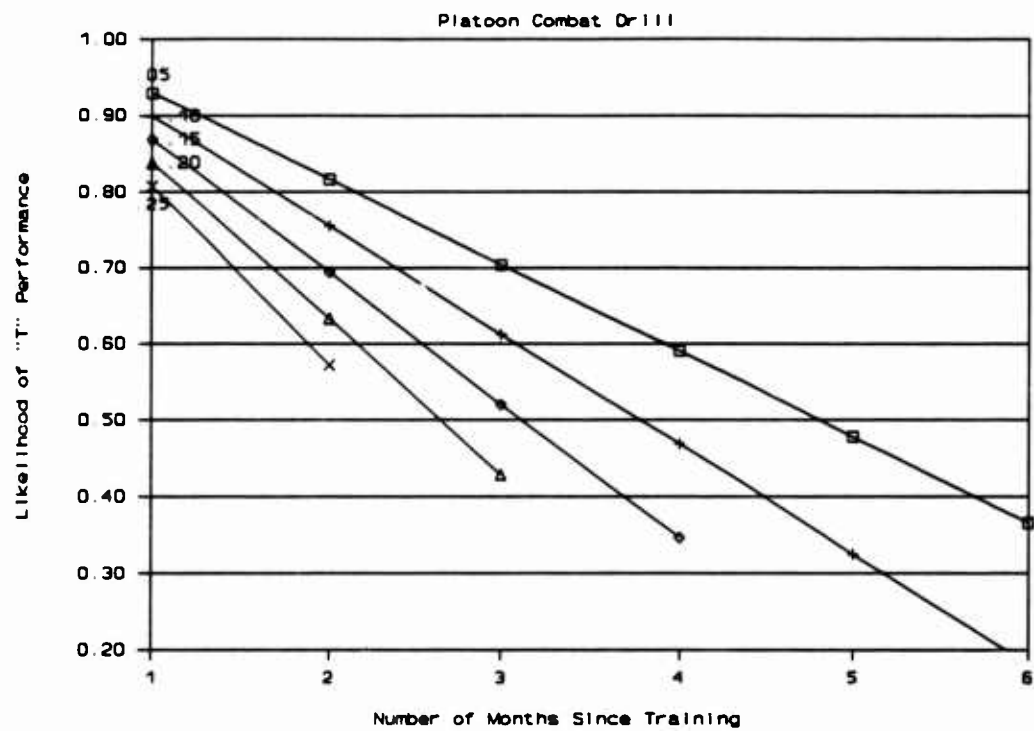
Mechanized Infantry Platoon Tasks



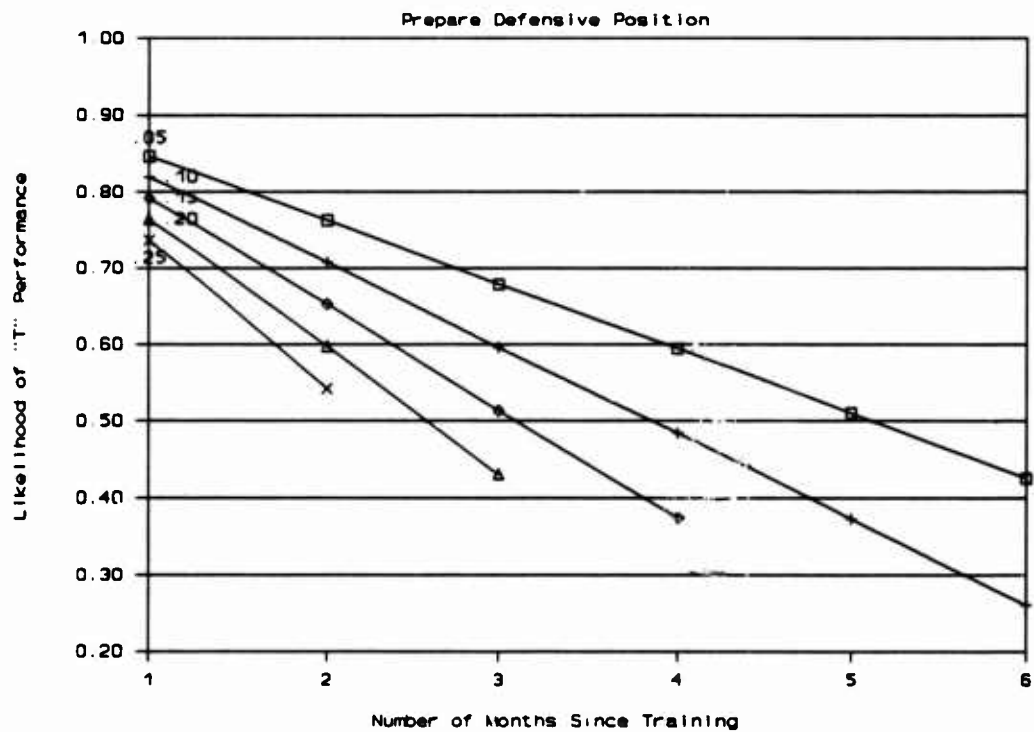
Mechanized Infantry Platoon Tasks



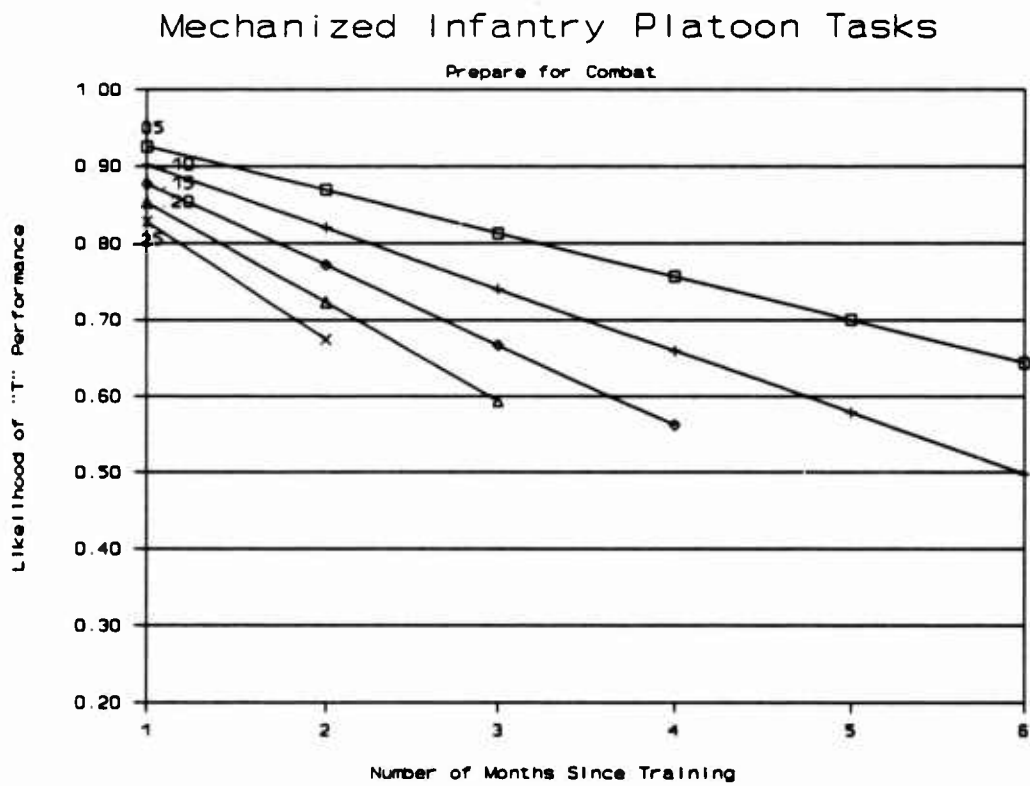
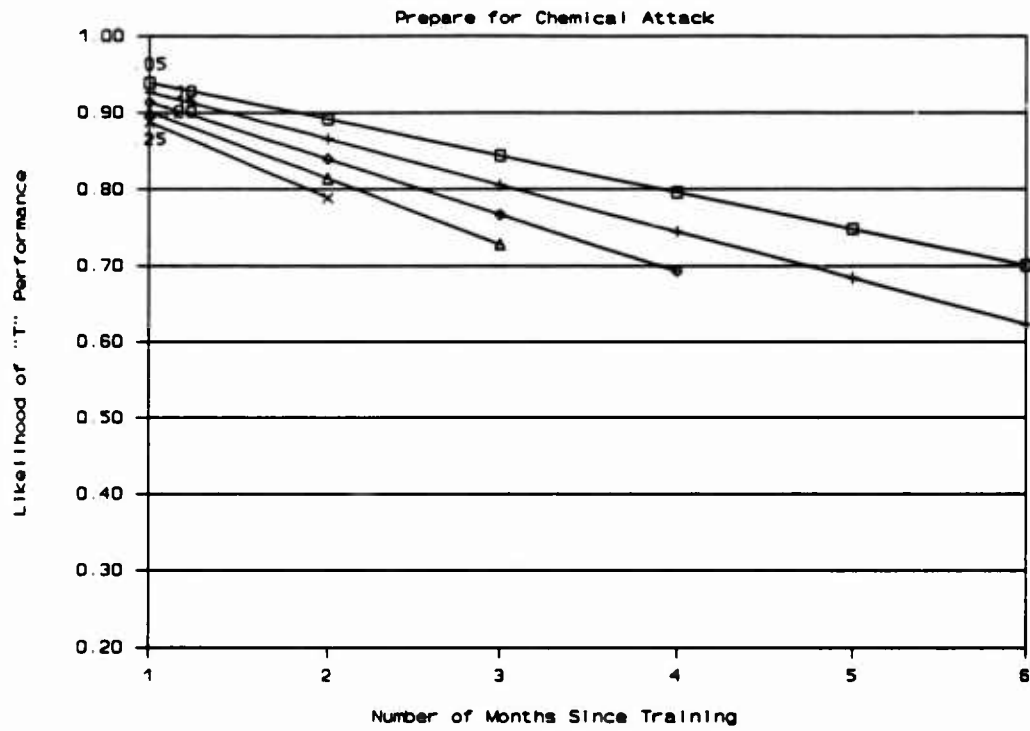
Mechanized Infantry Platoon Tasks



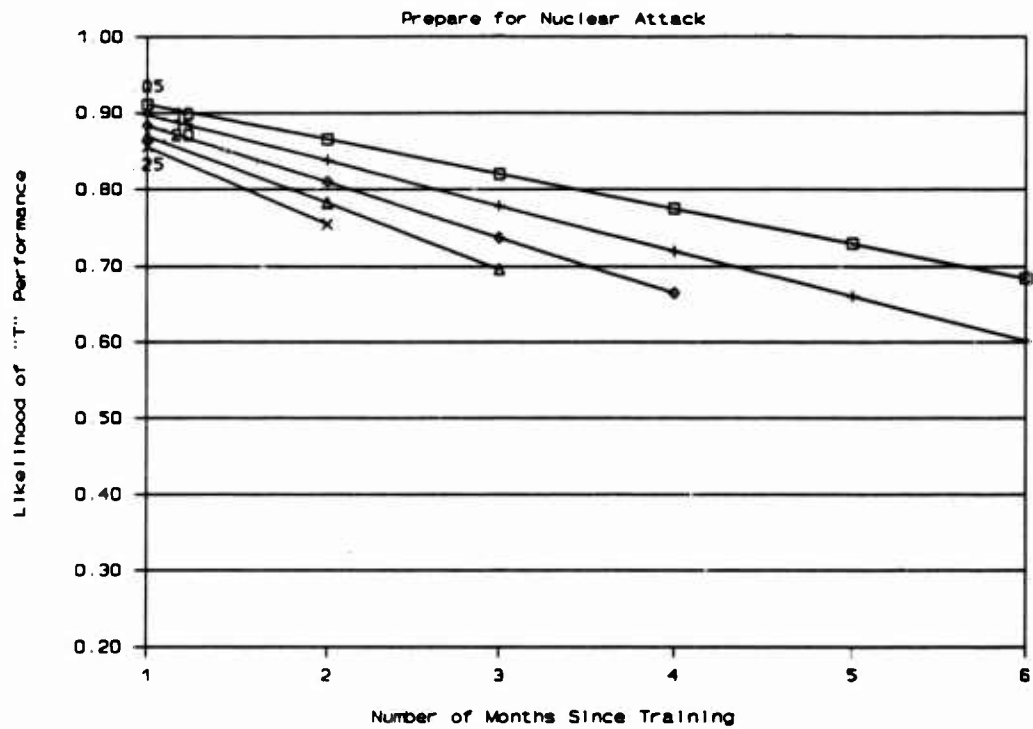
Mechanized Infantry Platoon Tasks



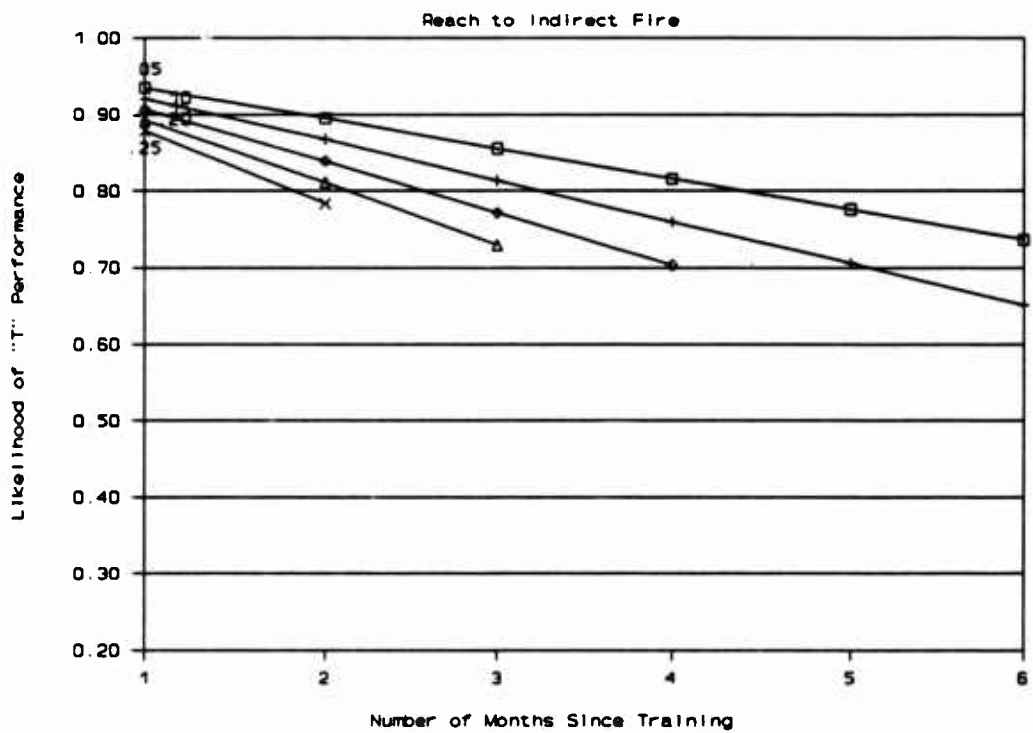
Mechanized Infantry Platoon Tasks



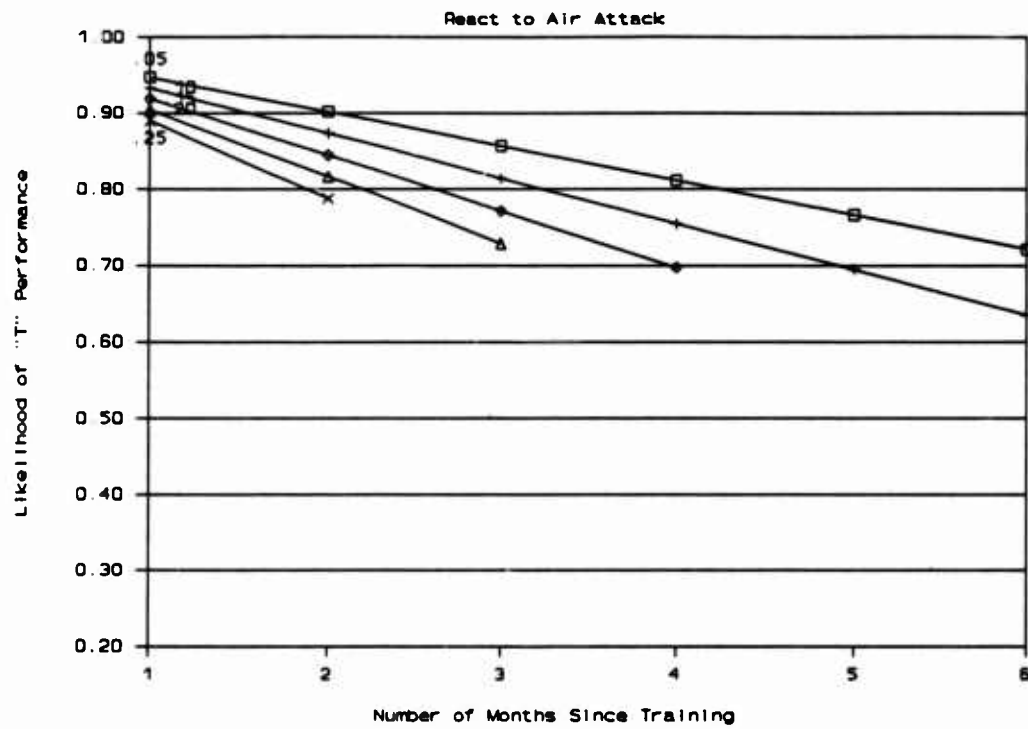
Mechanized Infantry Platoon Tasks



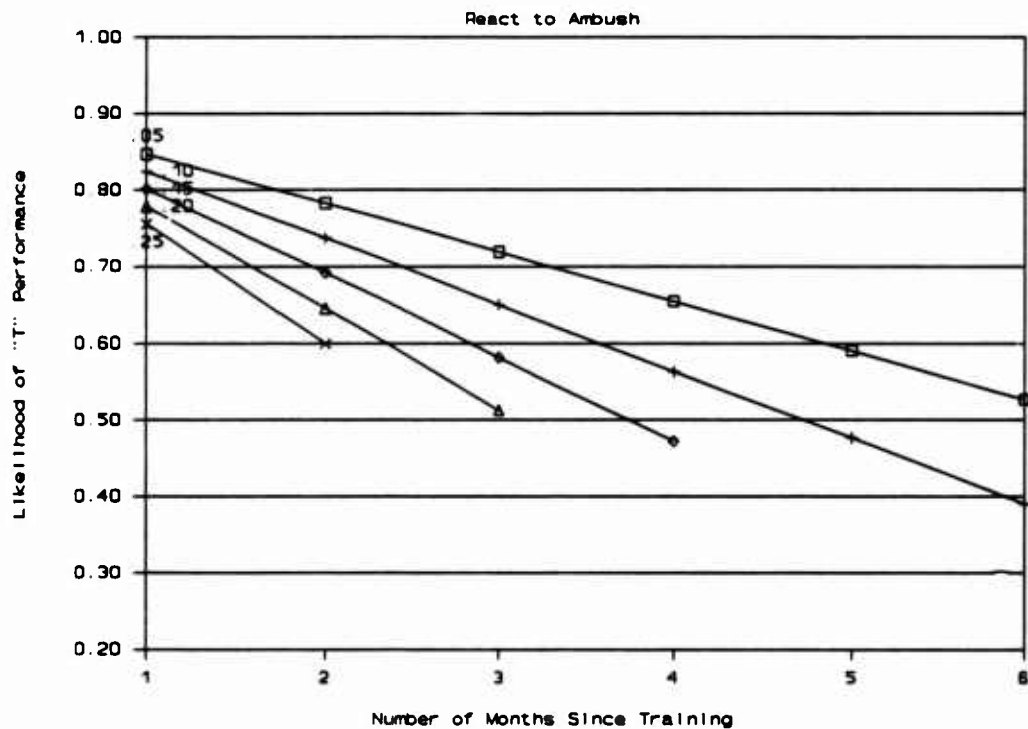
Mechanized Infantry Platoon Tasks



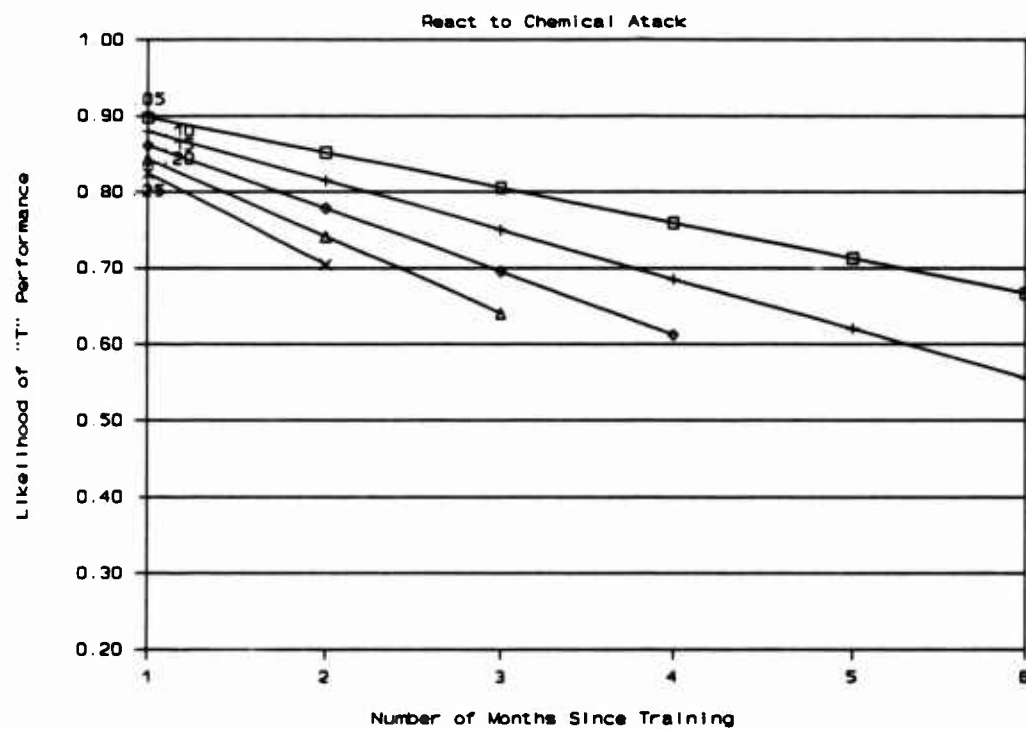
Mechanized Infantry Platoon Tasks



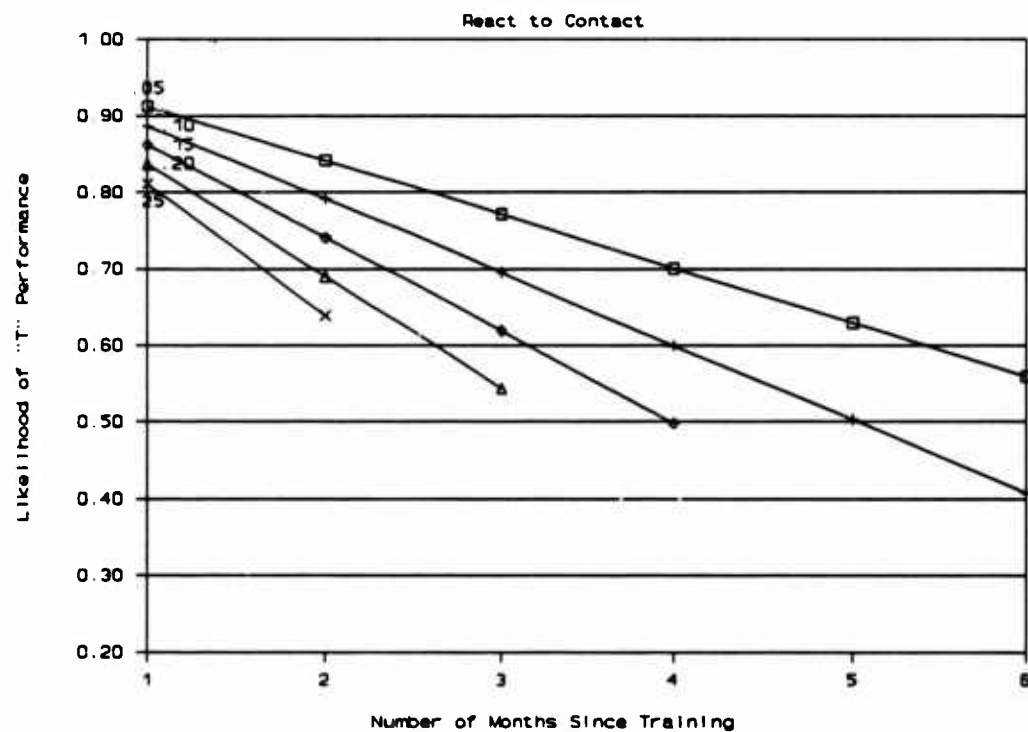
Mechanized Infantry Platoon Tasks



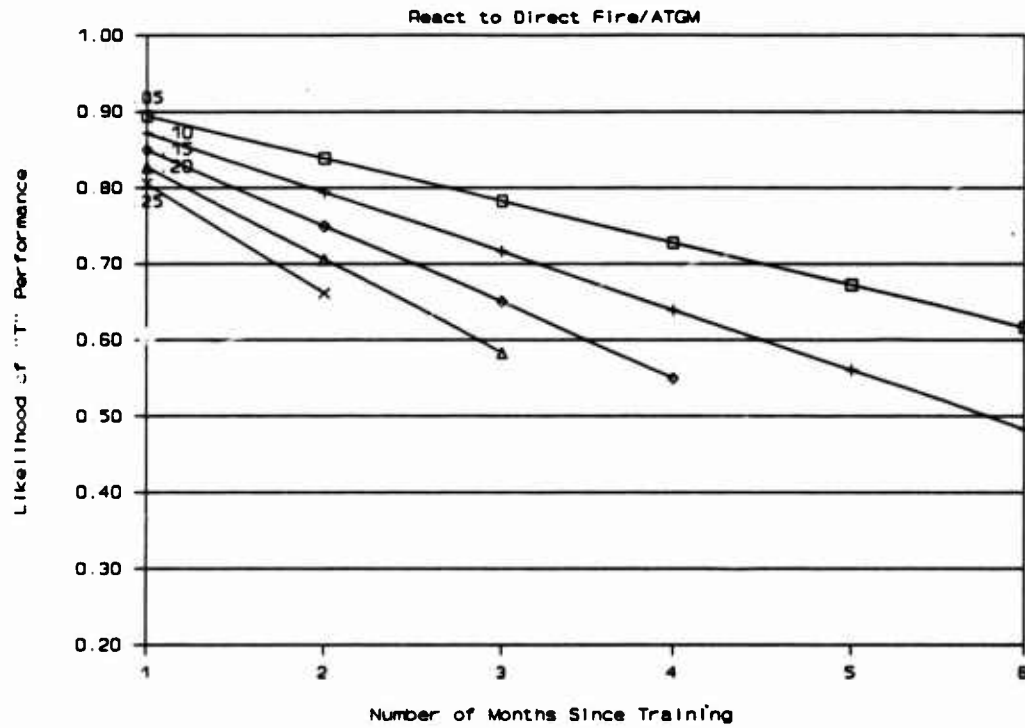
Mechanized Infantry Platoon Tasks



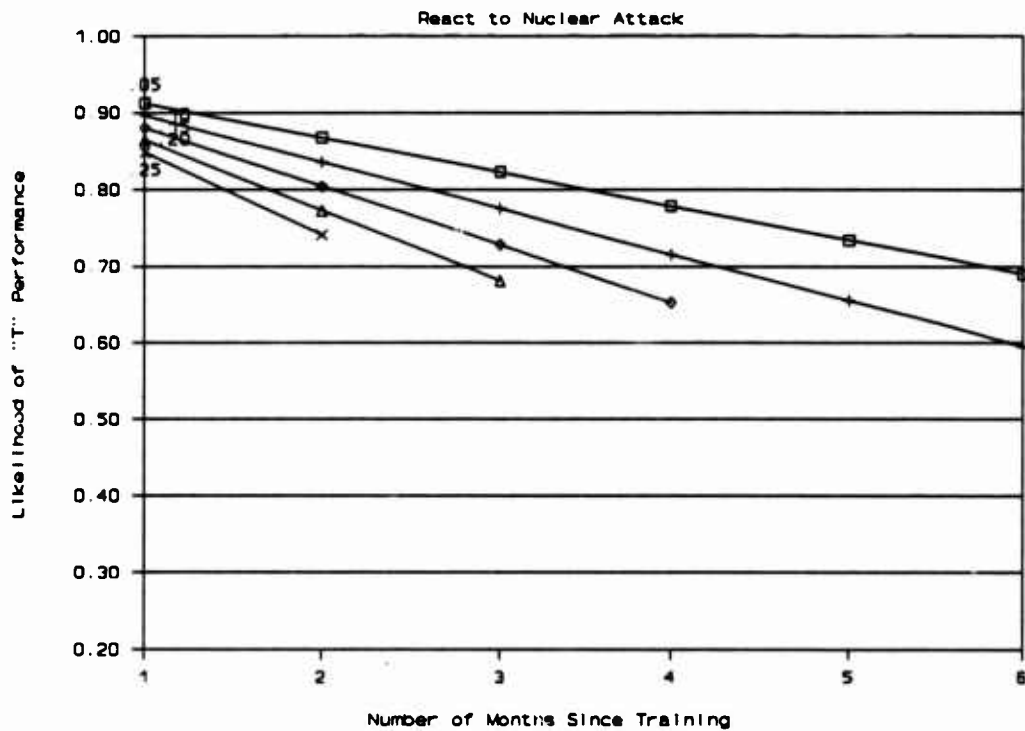
Mechanized Infantry Platoon Tasks



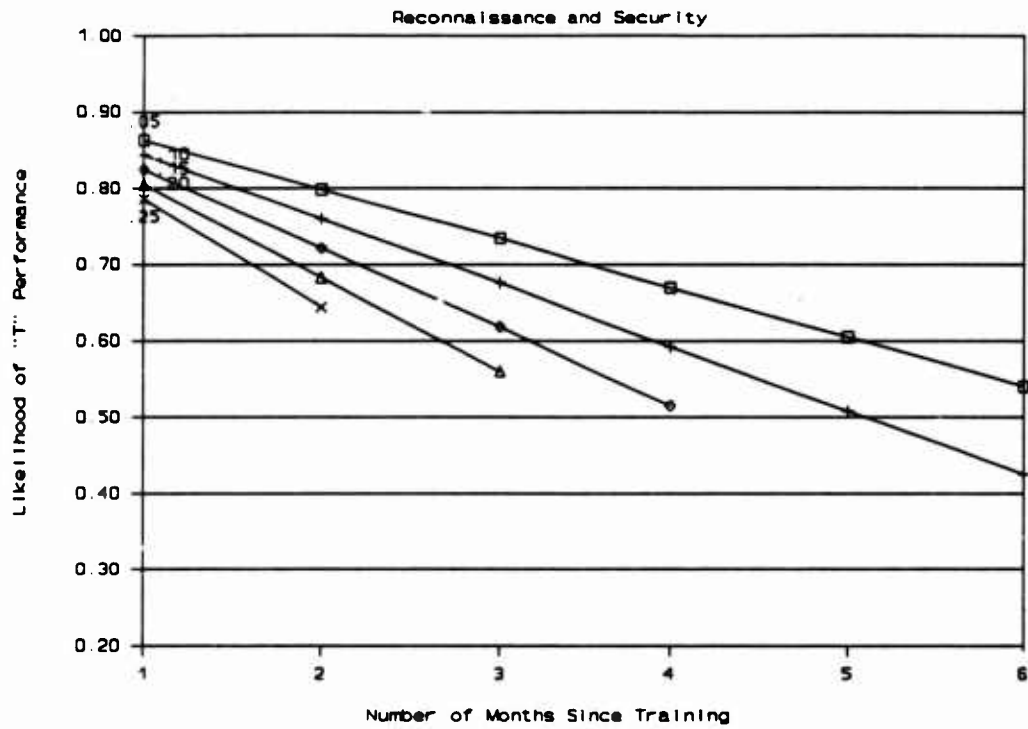
Mechanized Infantry Platoon Tasks



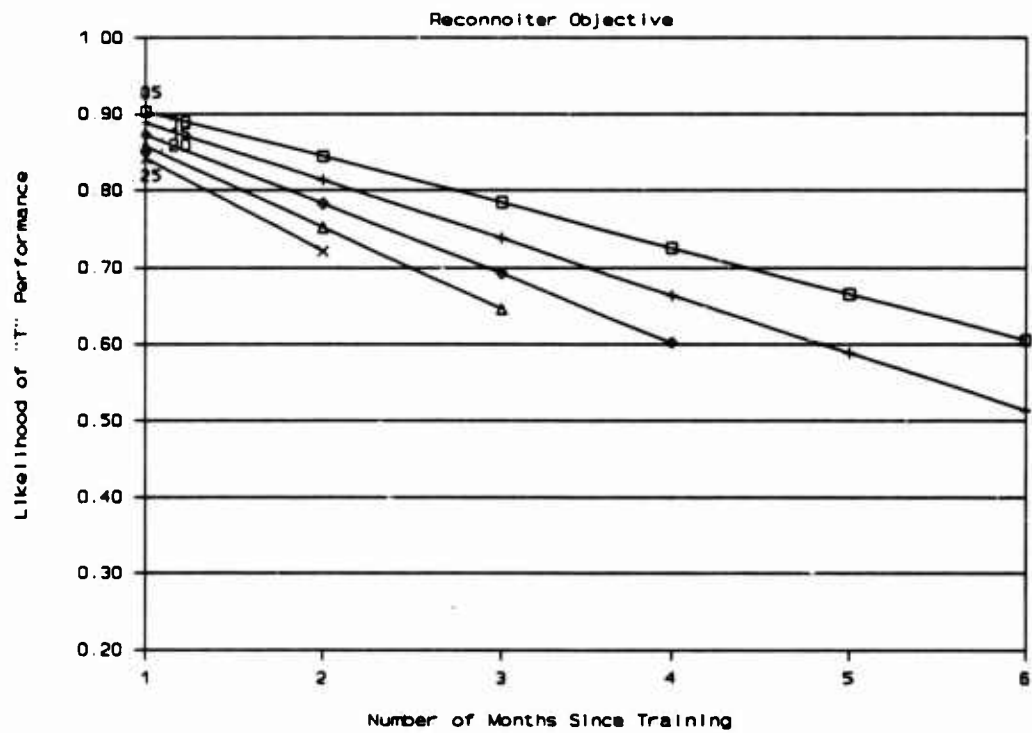
Mechanized Infantry Platoon Tasks



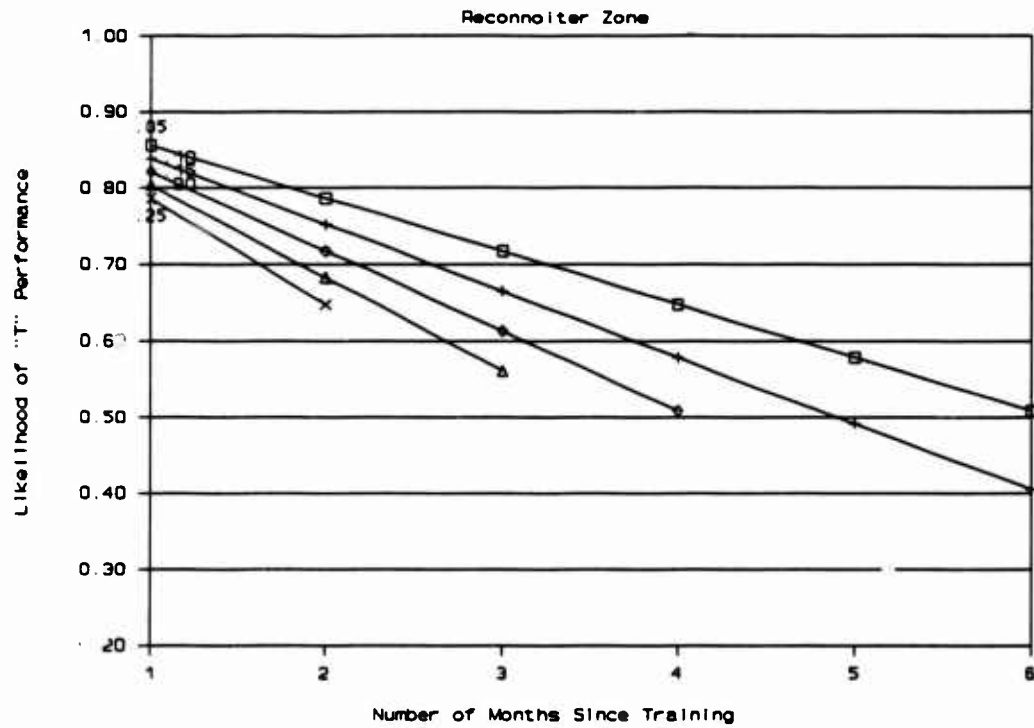
Mechanized Infantry Platoon Tasks



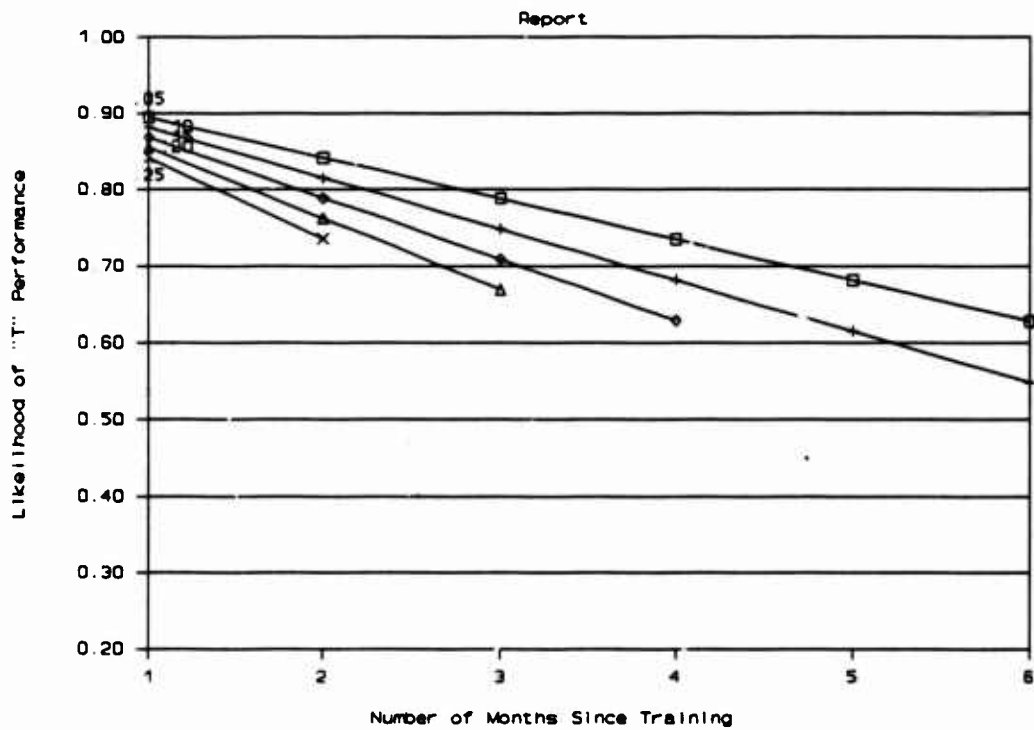
Mechanized Infantry Platoon Tasks



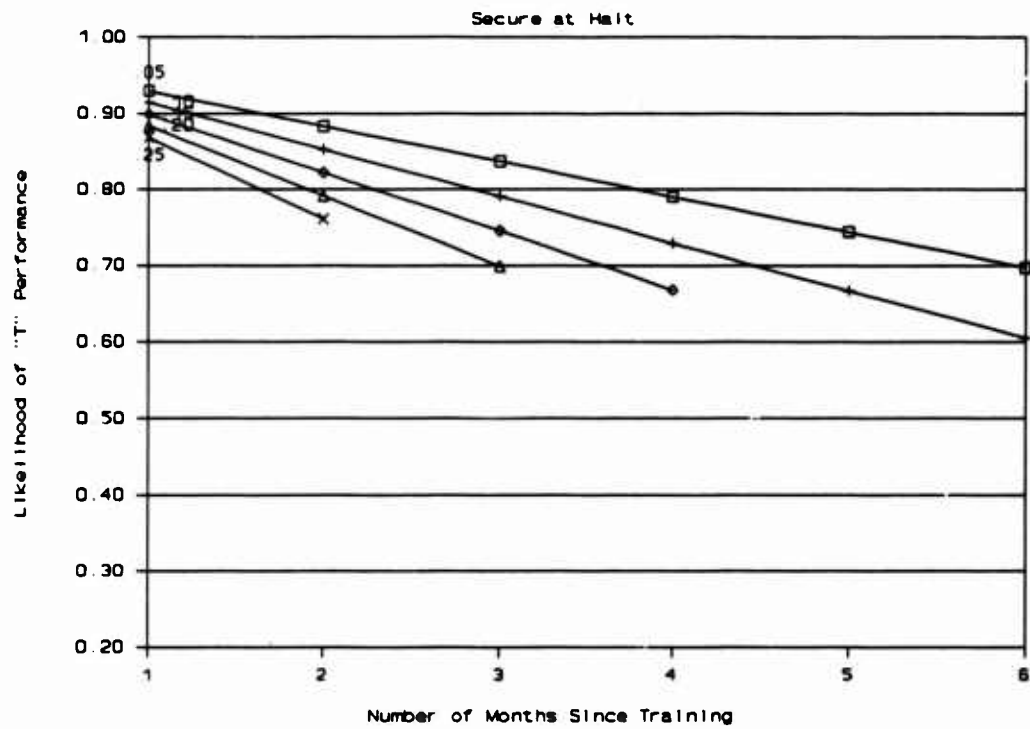
Mechanized Infantry Platoon Tasks



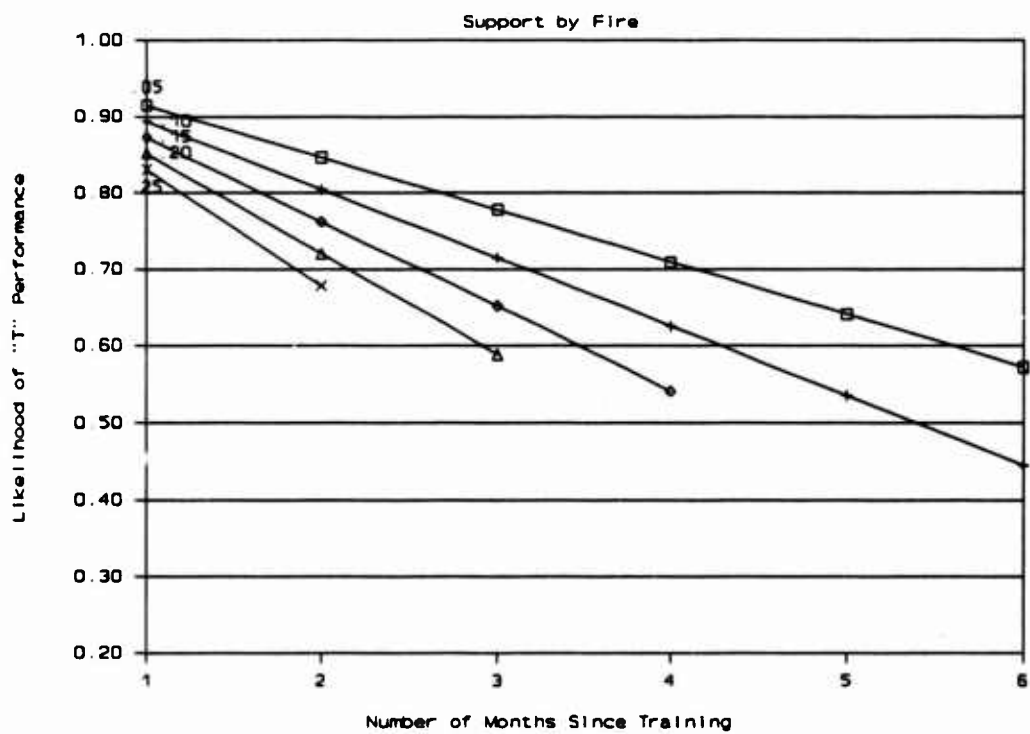
Mechanized Infantry Platoon Tasks



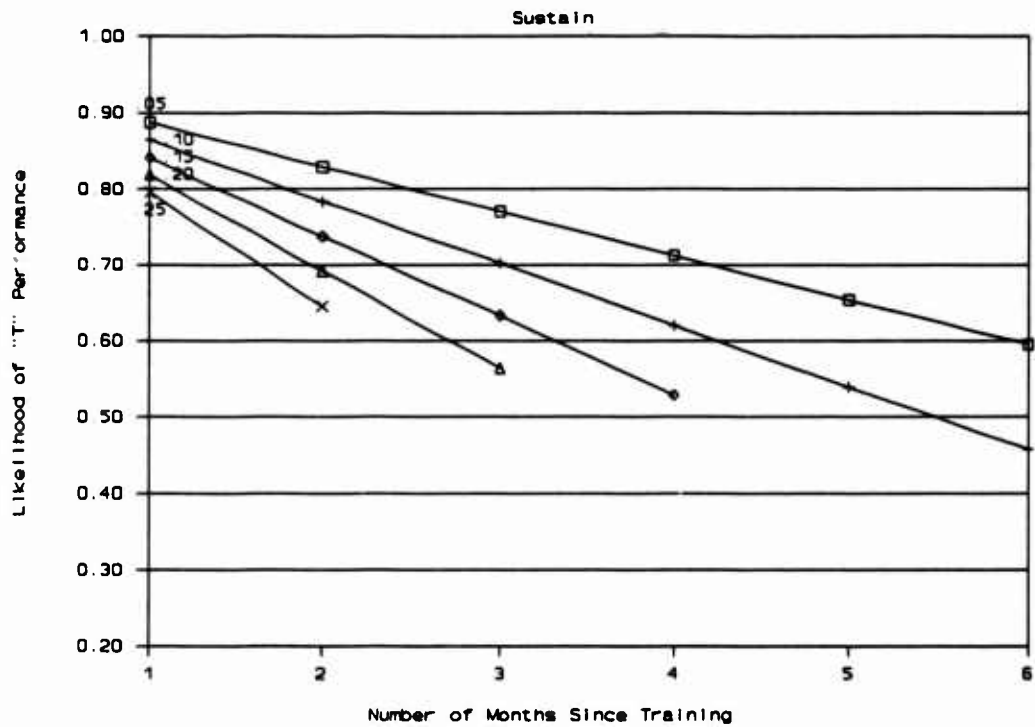
Mechanized Infantry Platoon Tasks



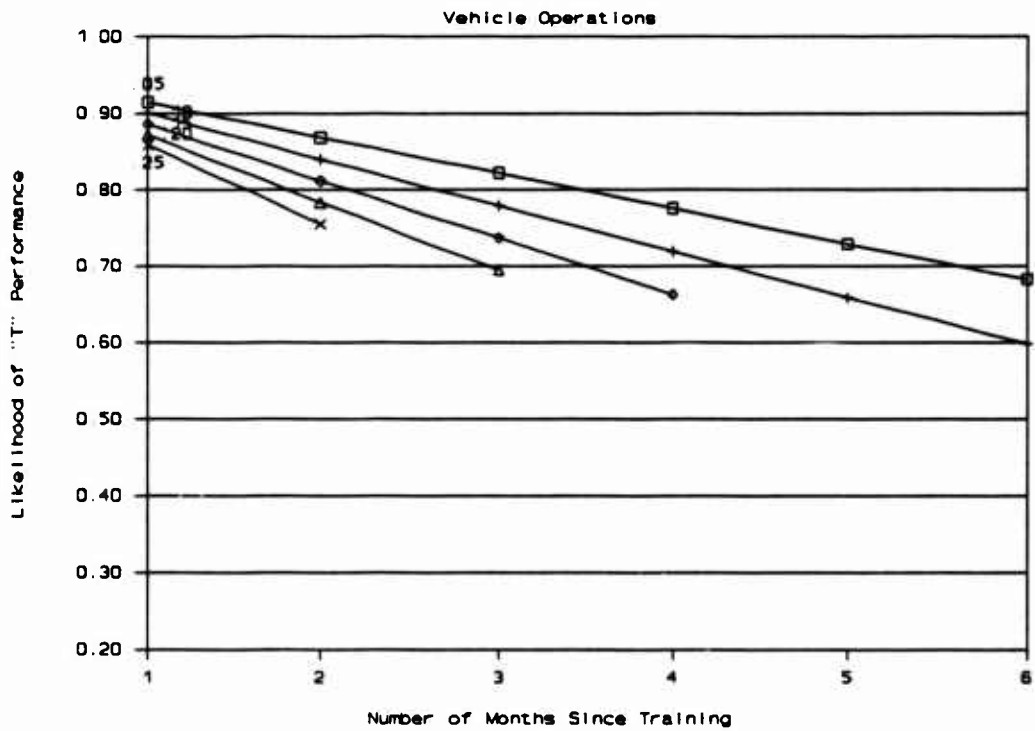
Mechanized Infantry Platoon Tasks



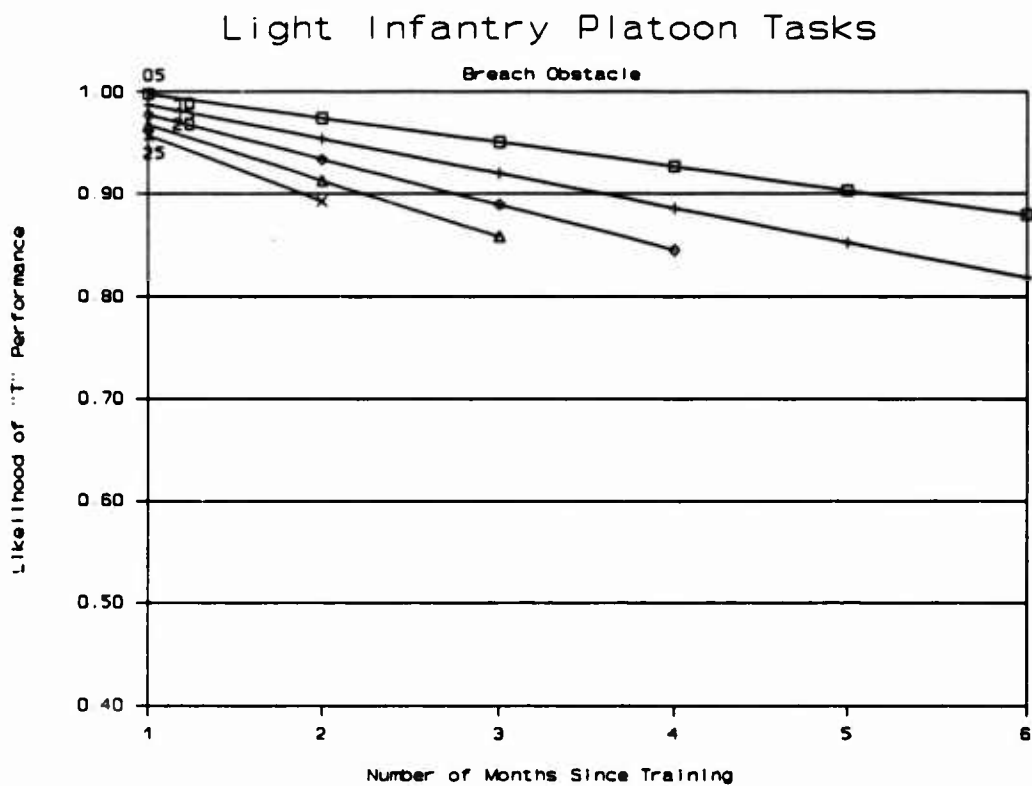
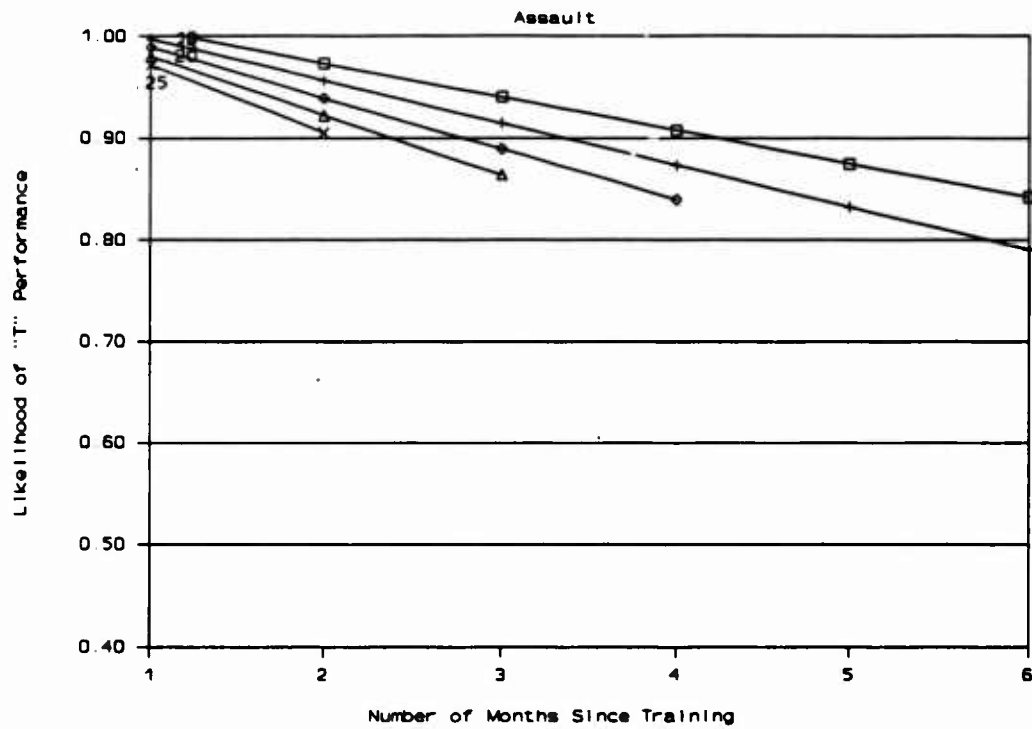
Mechanized Infantry Platoon Tasks



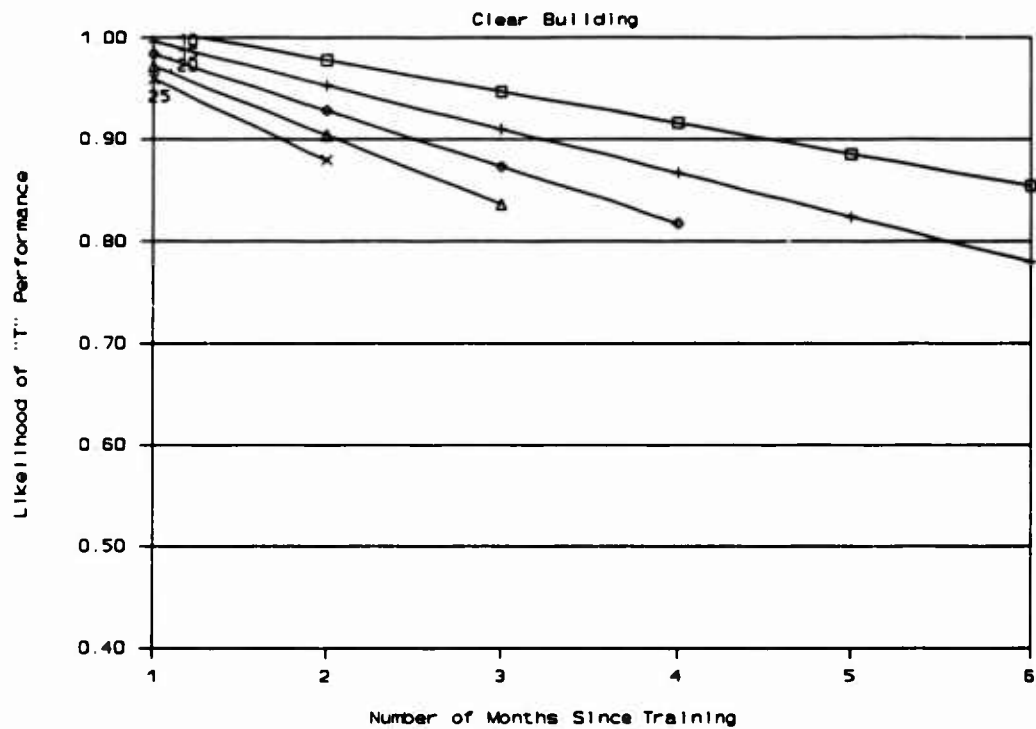
Mechanized Infantry Platoon Tasks



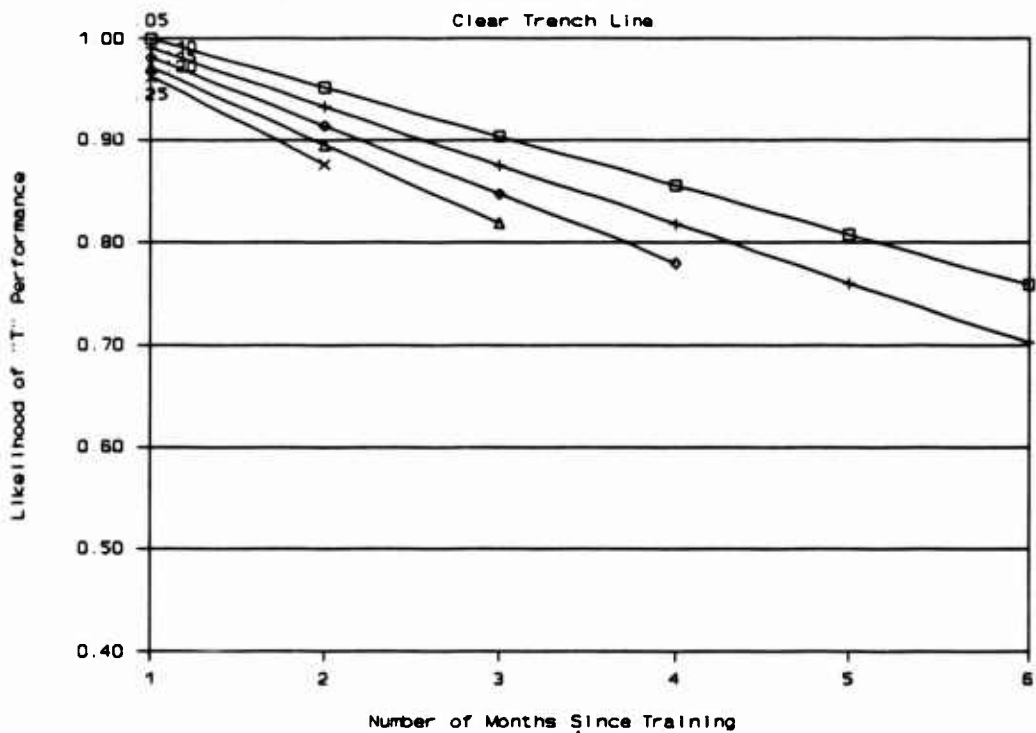
Light Infantry Platoon Tasks



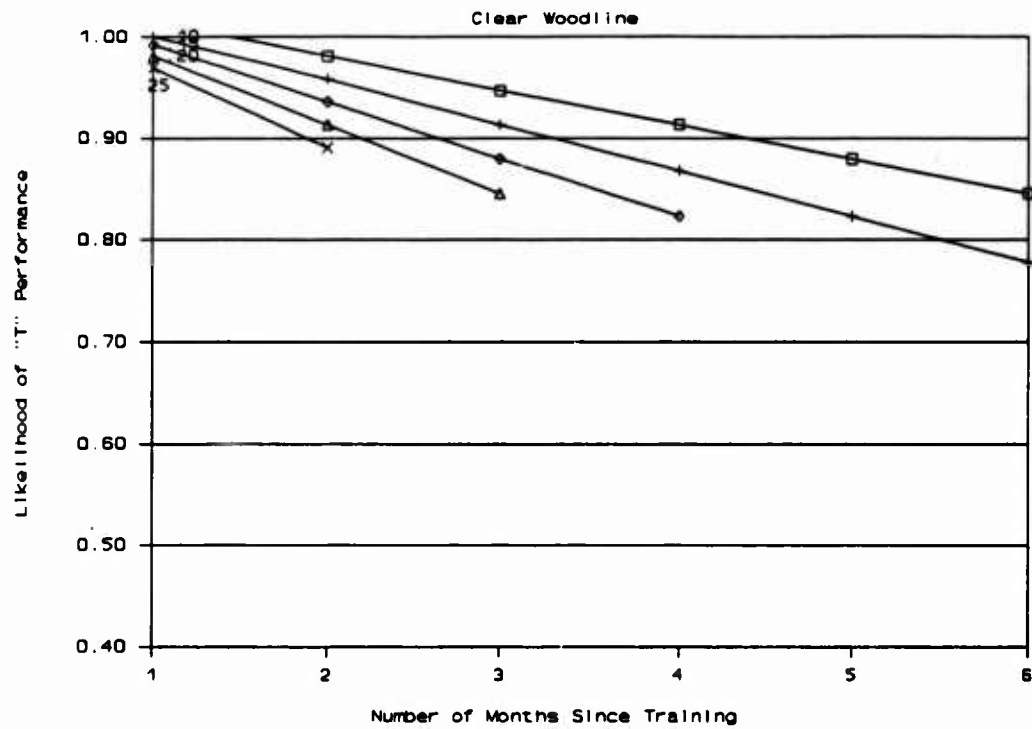
Light Infantry Platoon Tasks



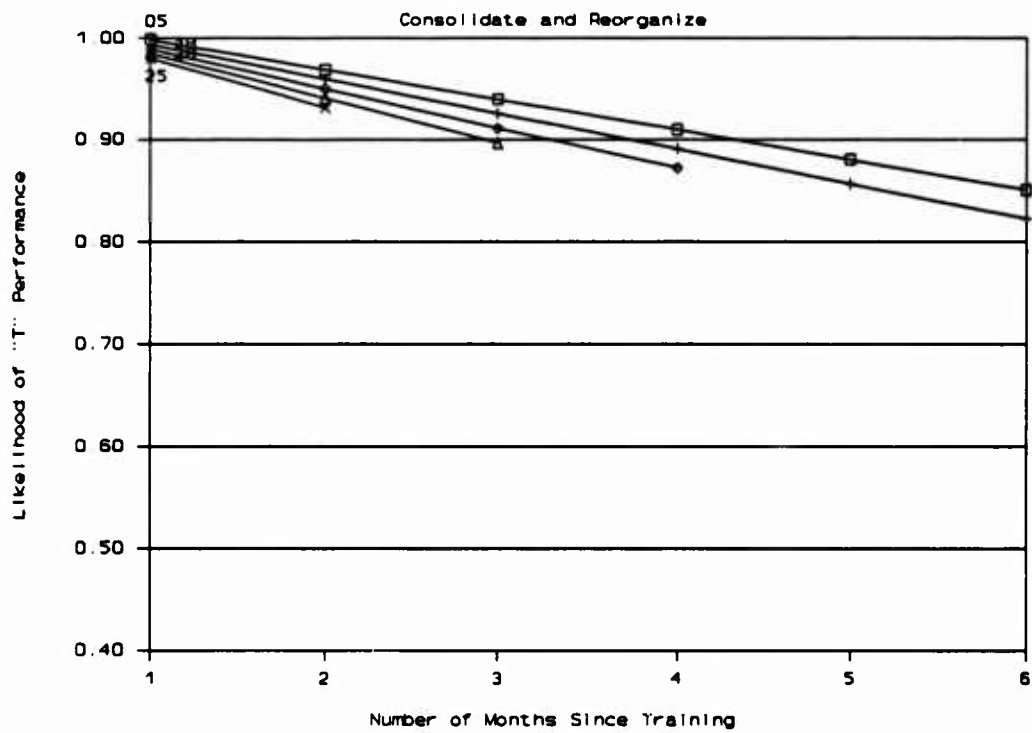
Light Infantry Platoon Tasks



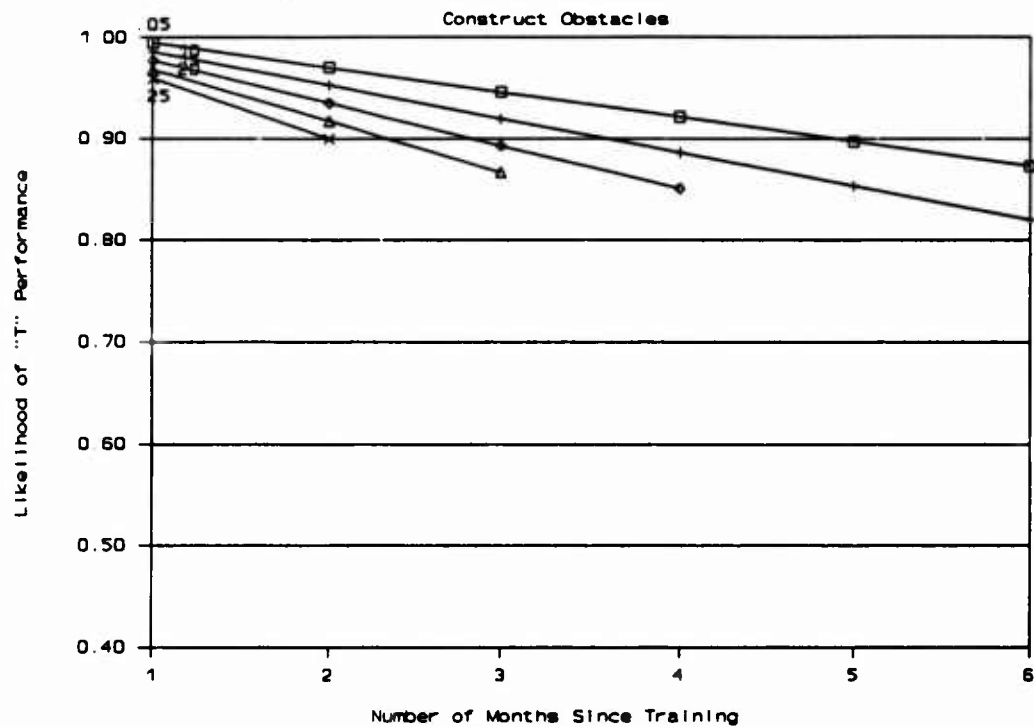
Light Infantry Platoon Tasks



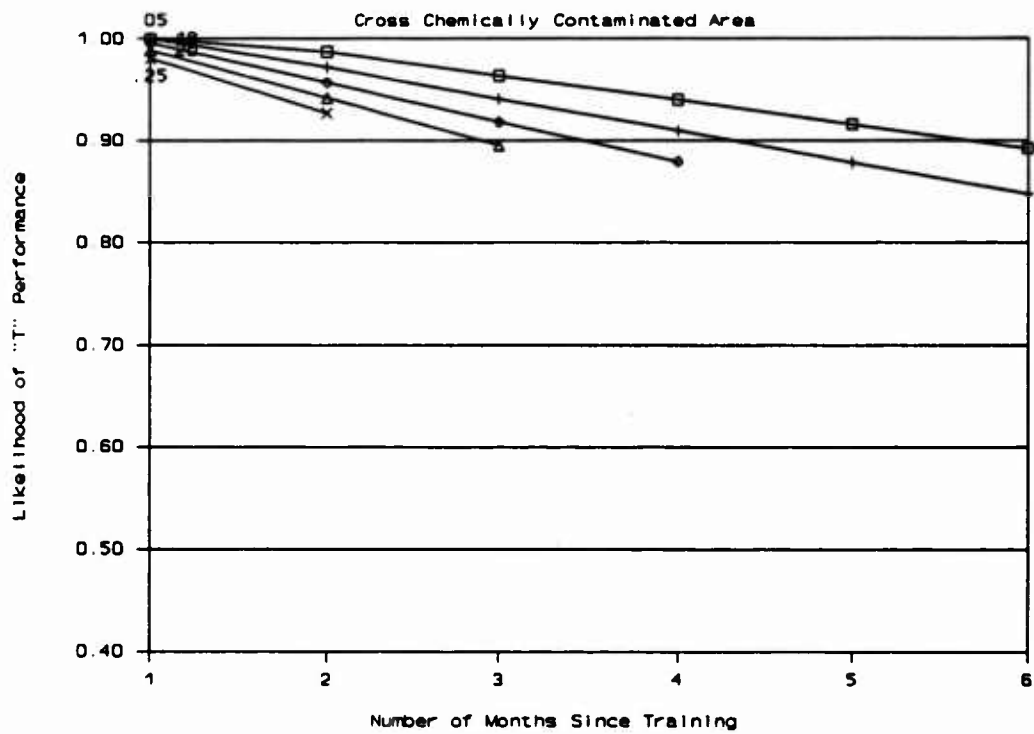
Light Infantry Platoon Tasks



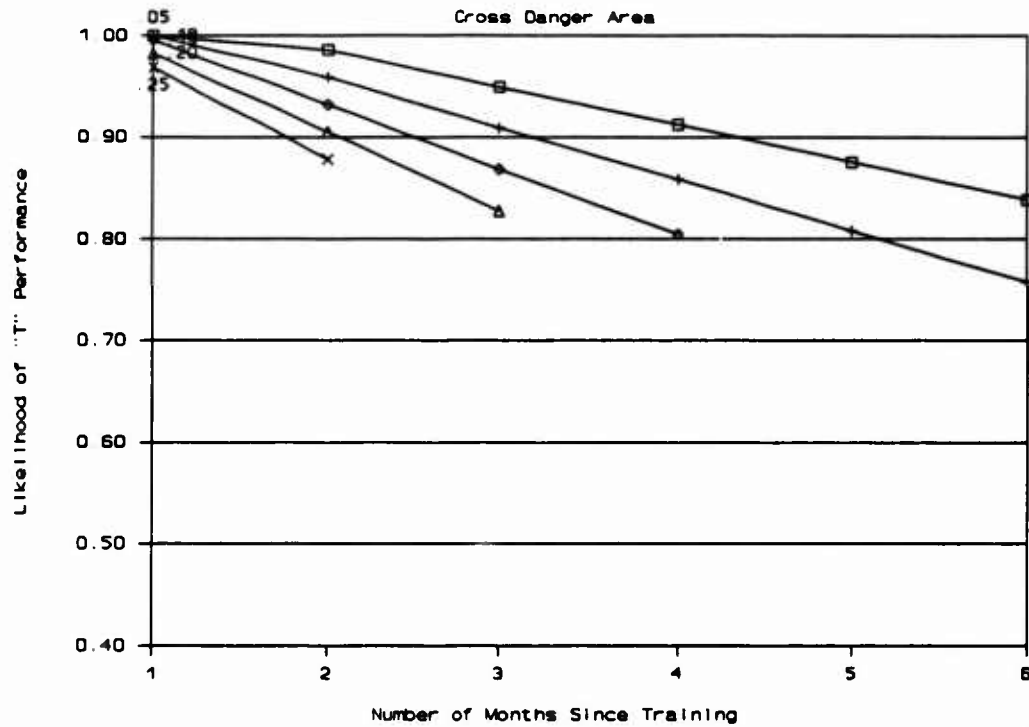
Light Infantry Platoon Tasks



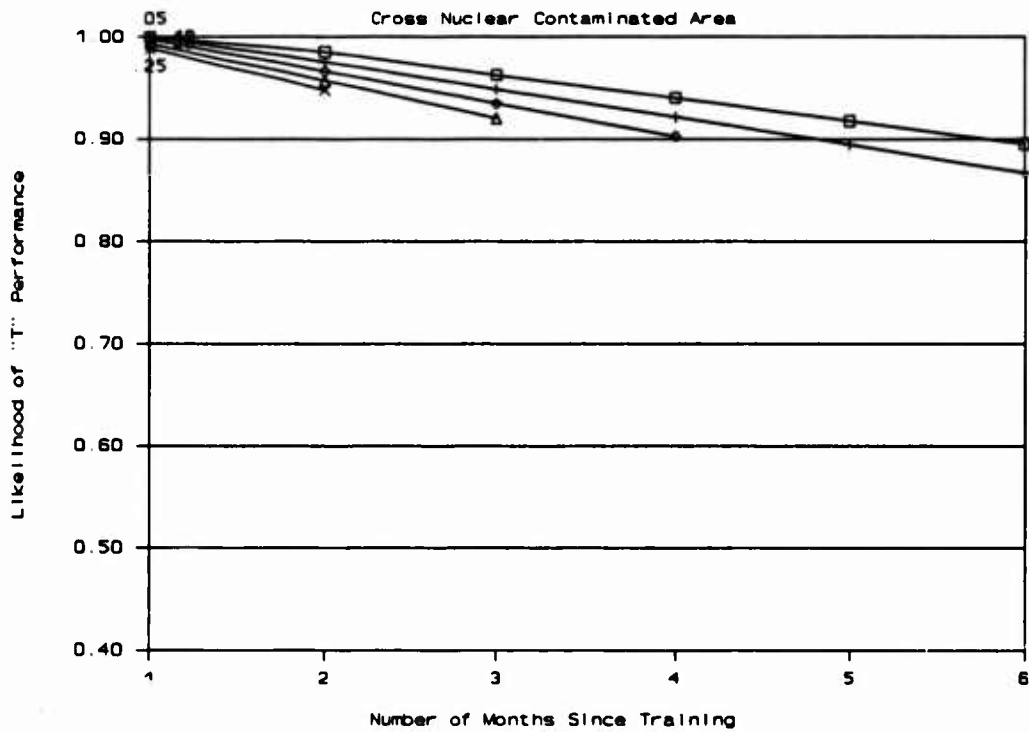
Light Infantry Platoon Tasks



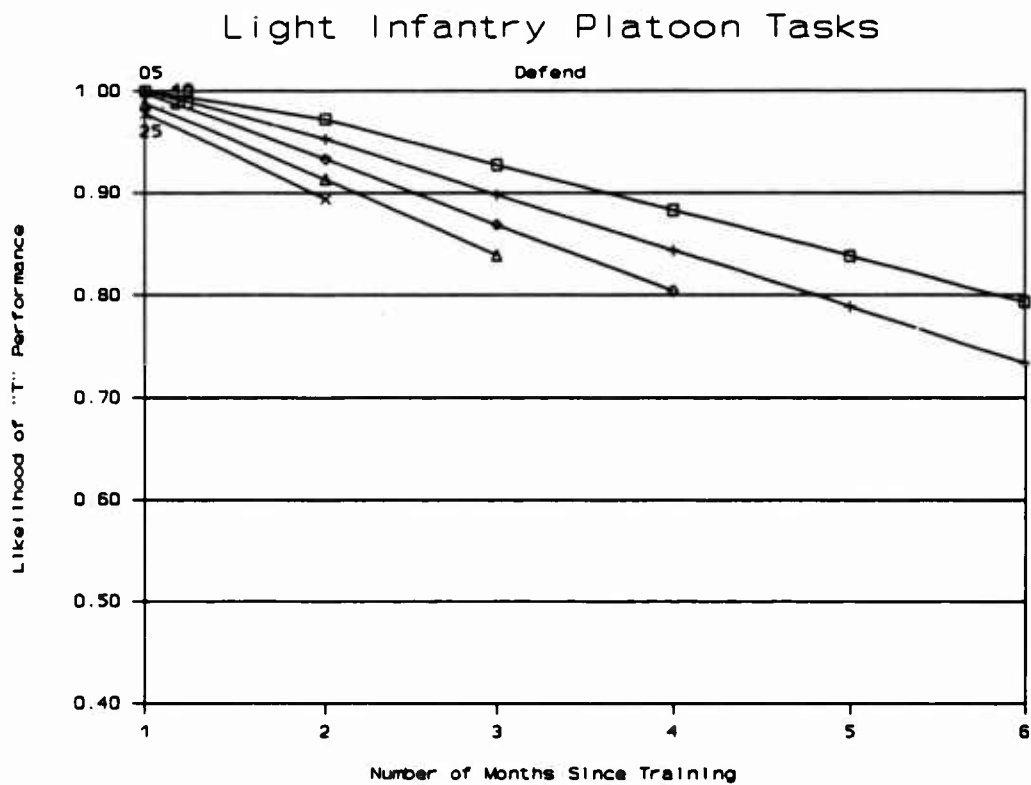
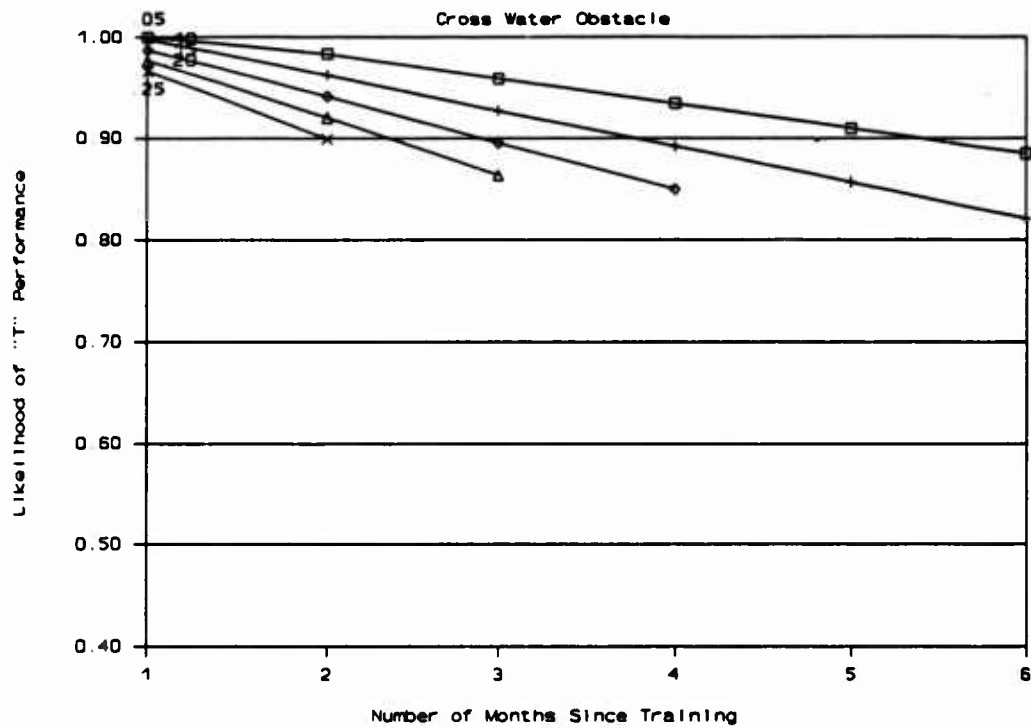
Light Infantry Platoon Tasks



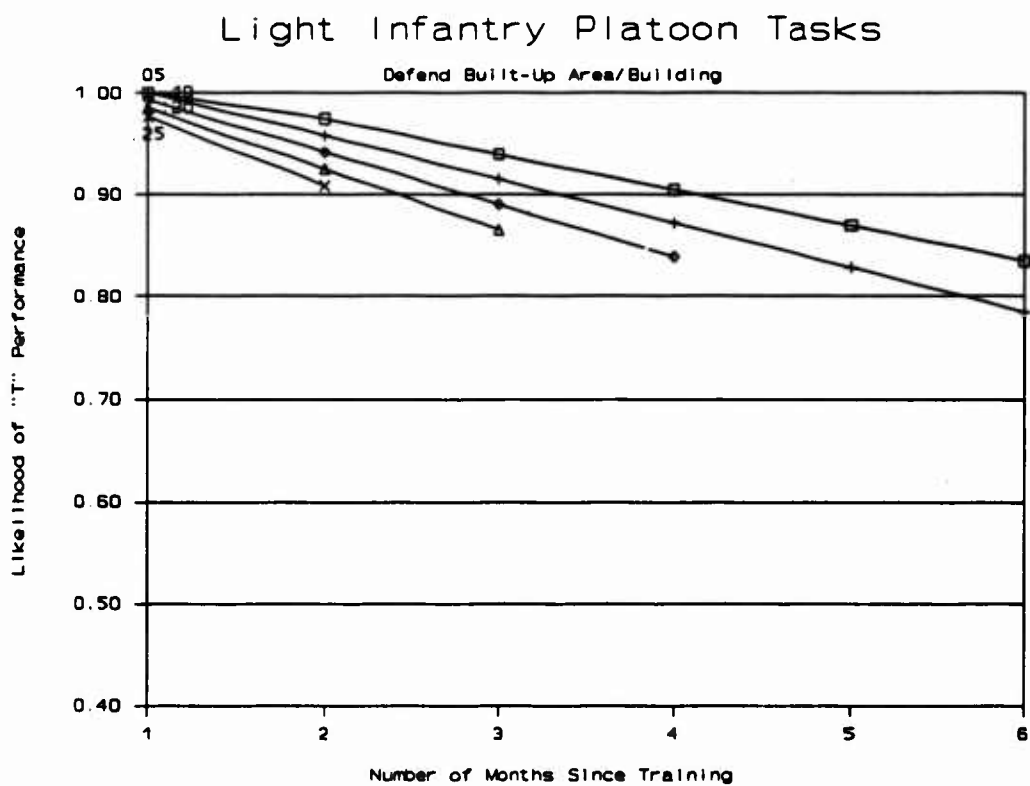
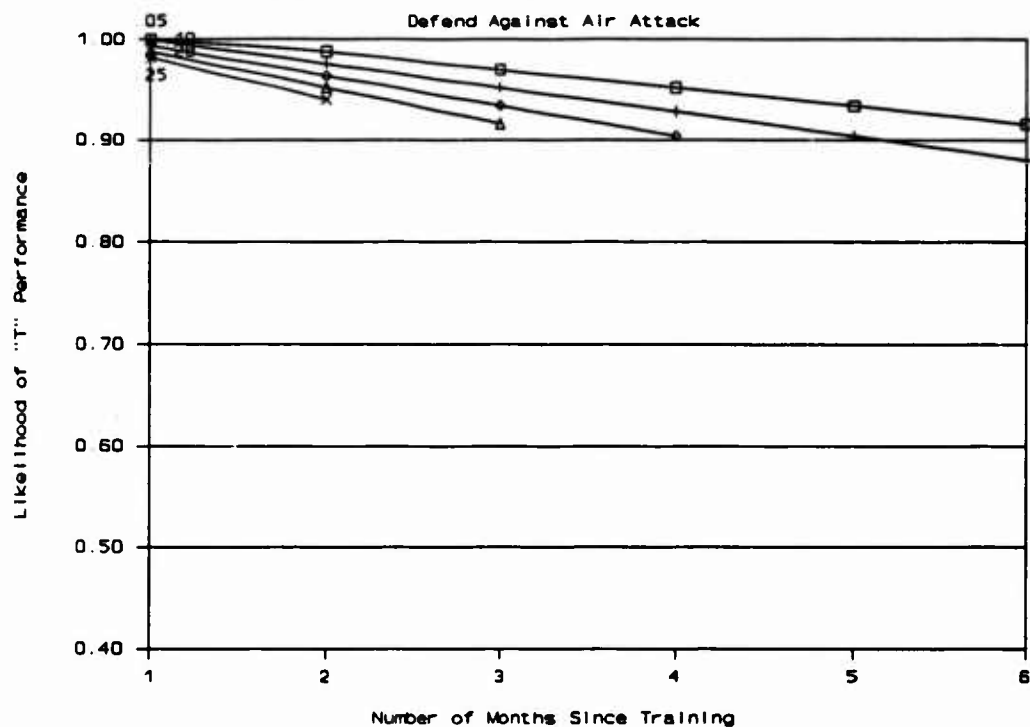
Light Infantry Platoon Tasks



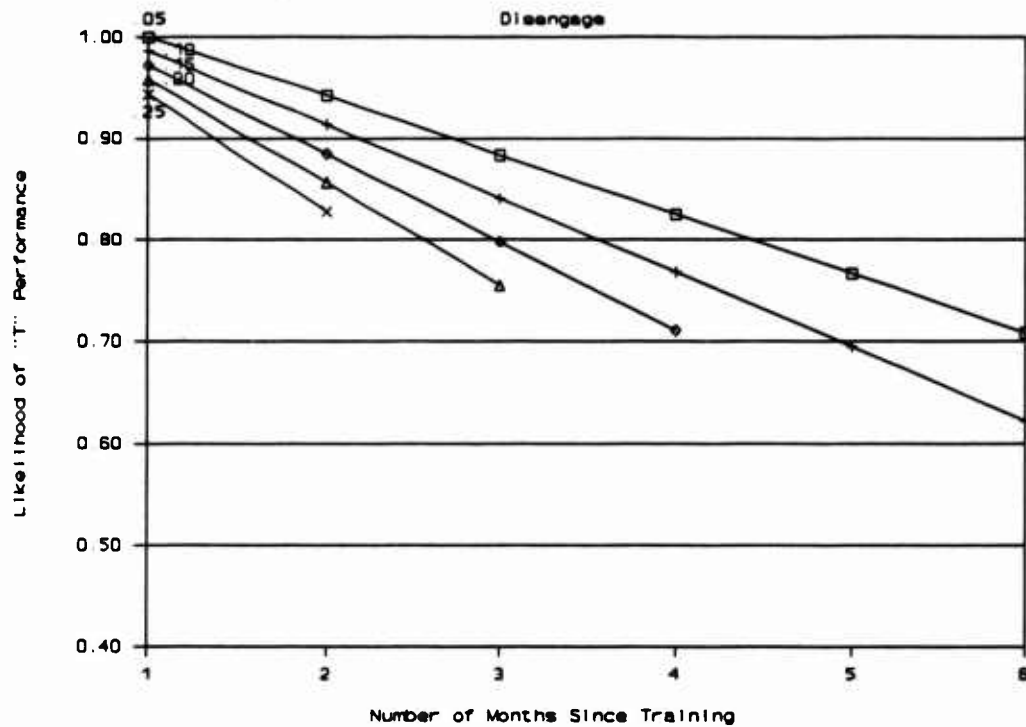
Light Infantry Platoon Tasks



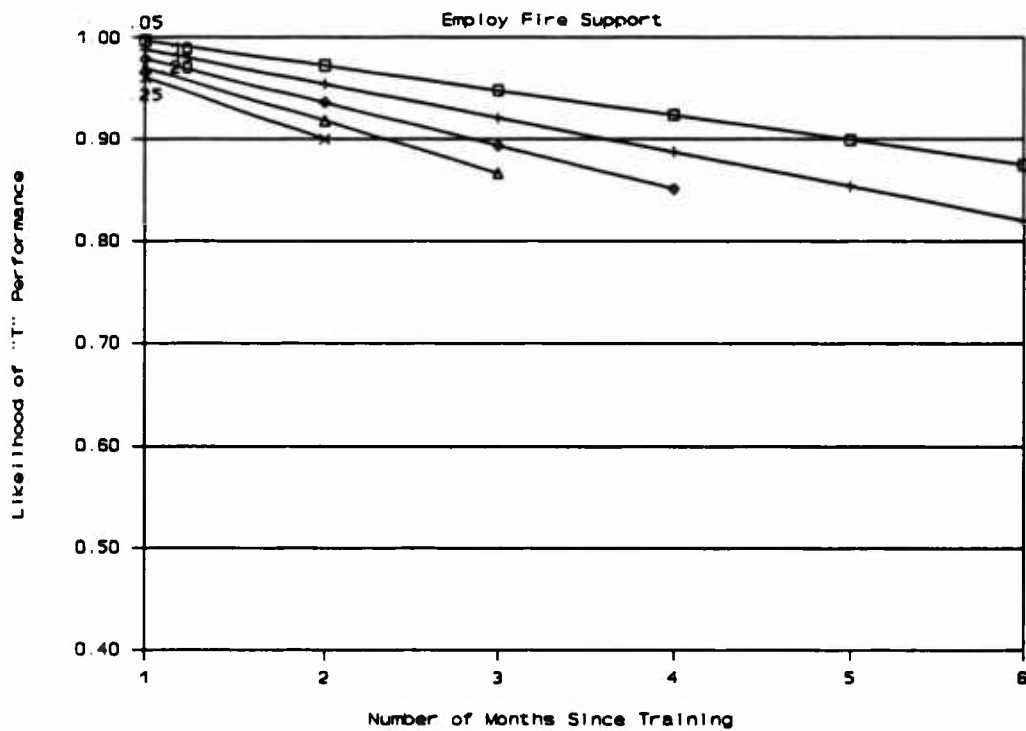
Light Infantry Platoon Tasks



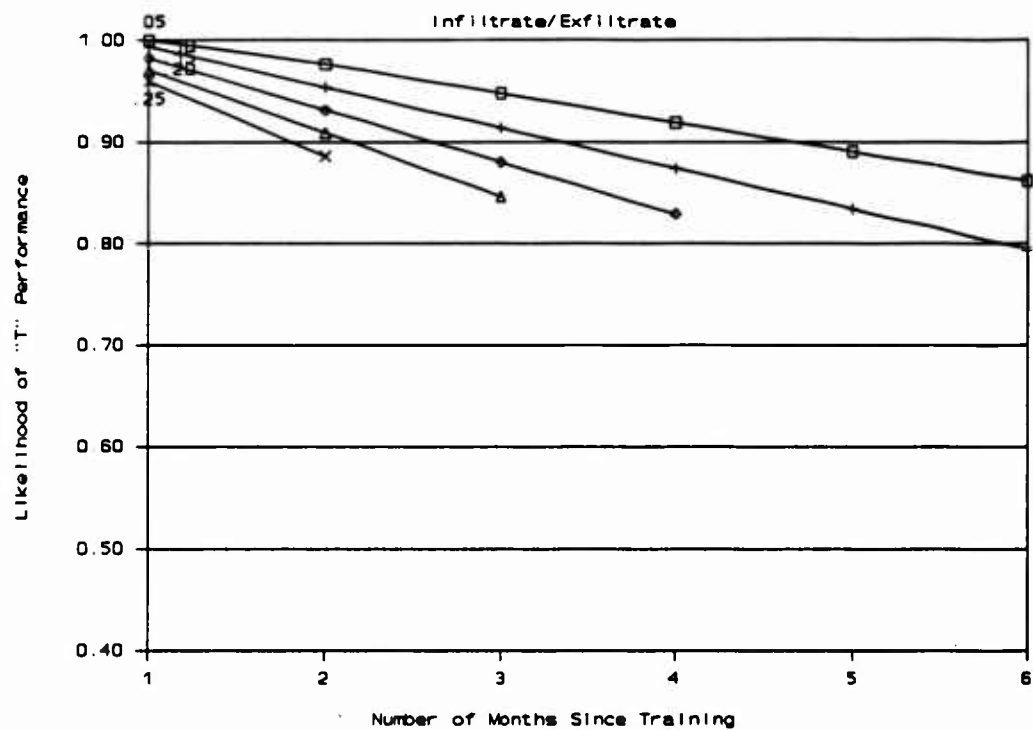
Light Infantry Platoon Tasks



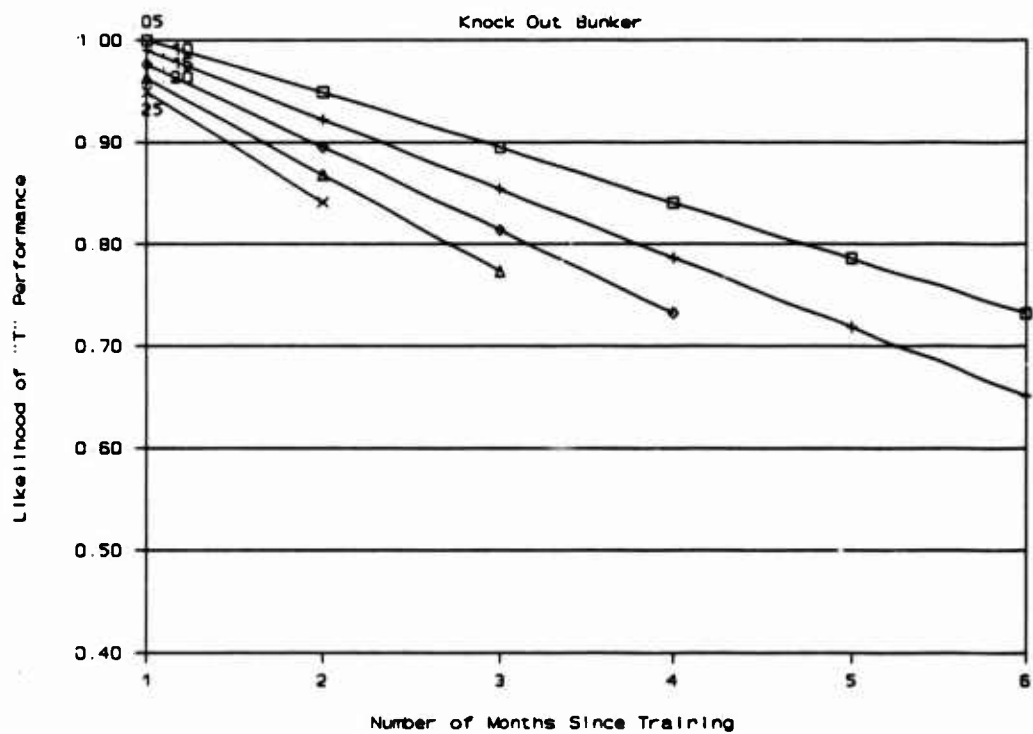
Light Infantry Platoon Tasks



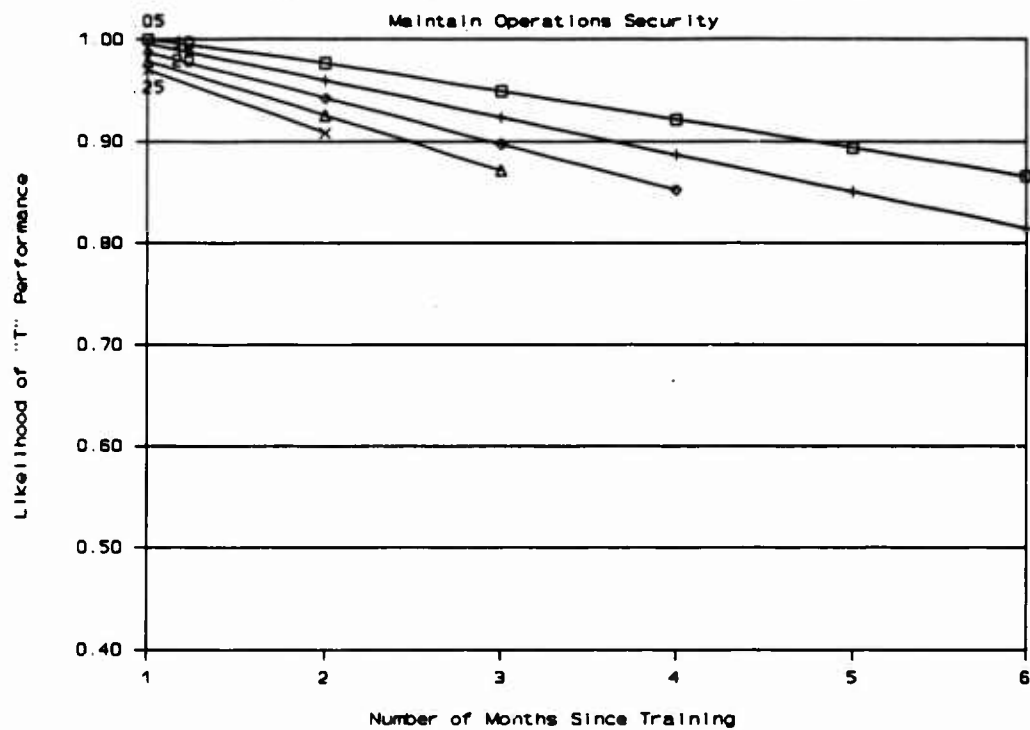
Light Infantry Platoon Tasks



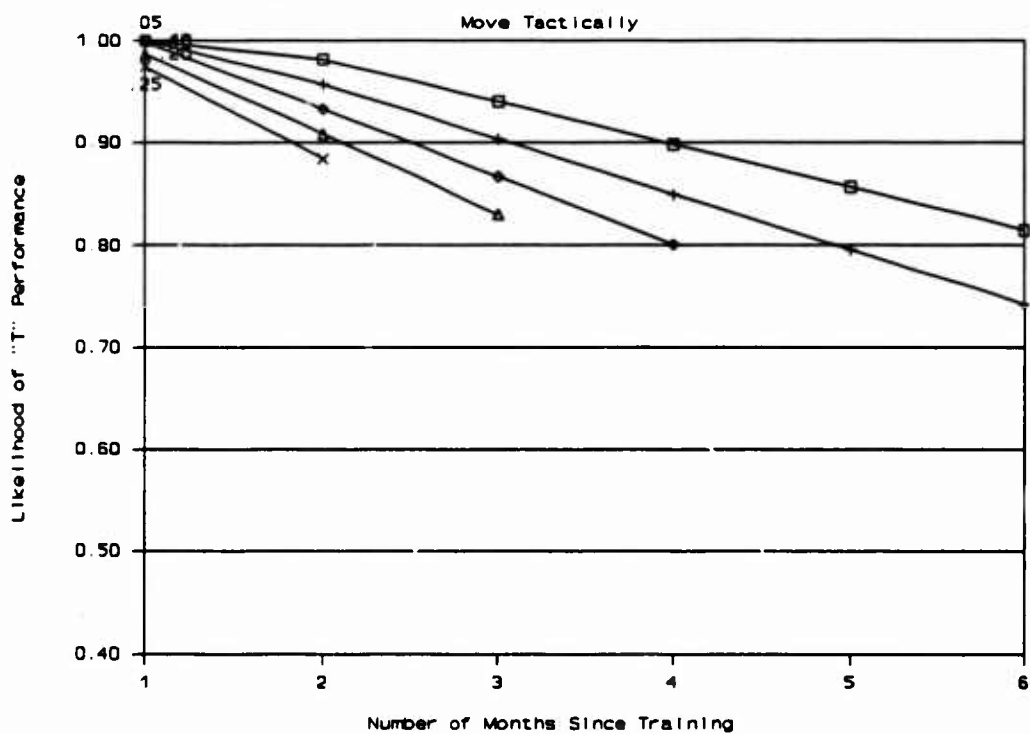
Light Infantry Platoon Tasks



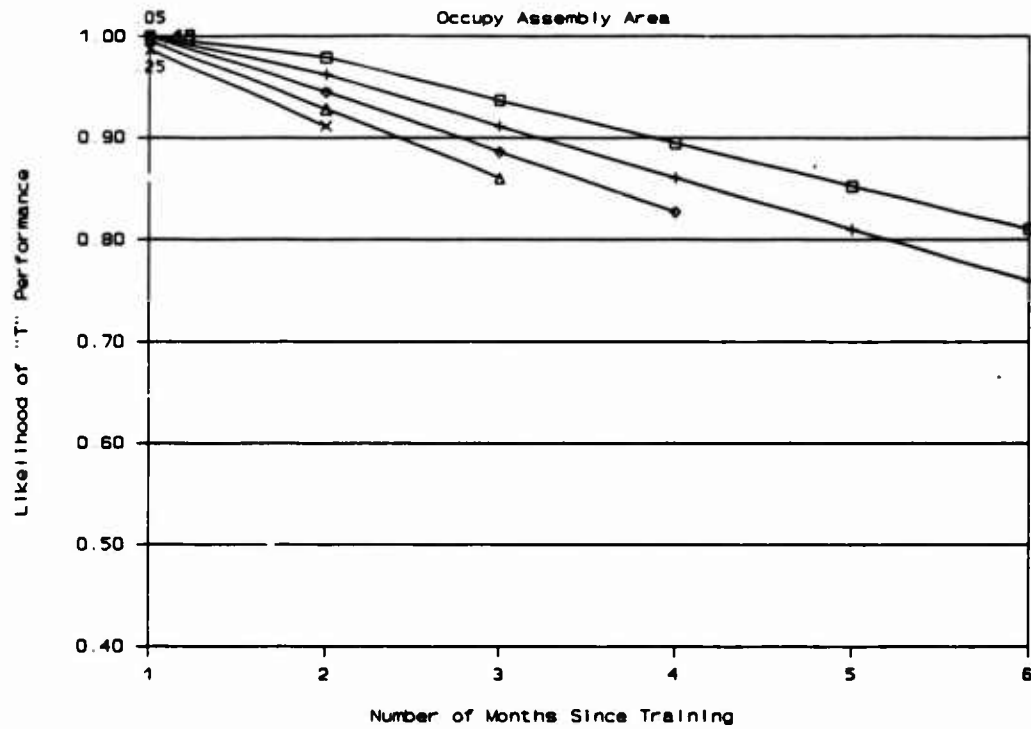
Light Infantry Platoon Tasks



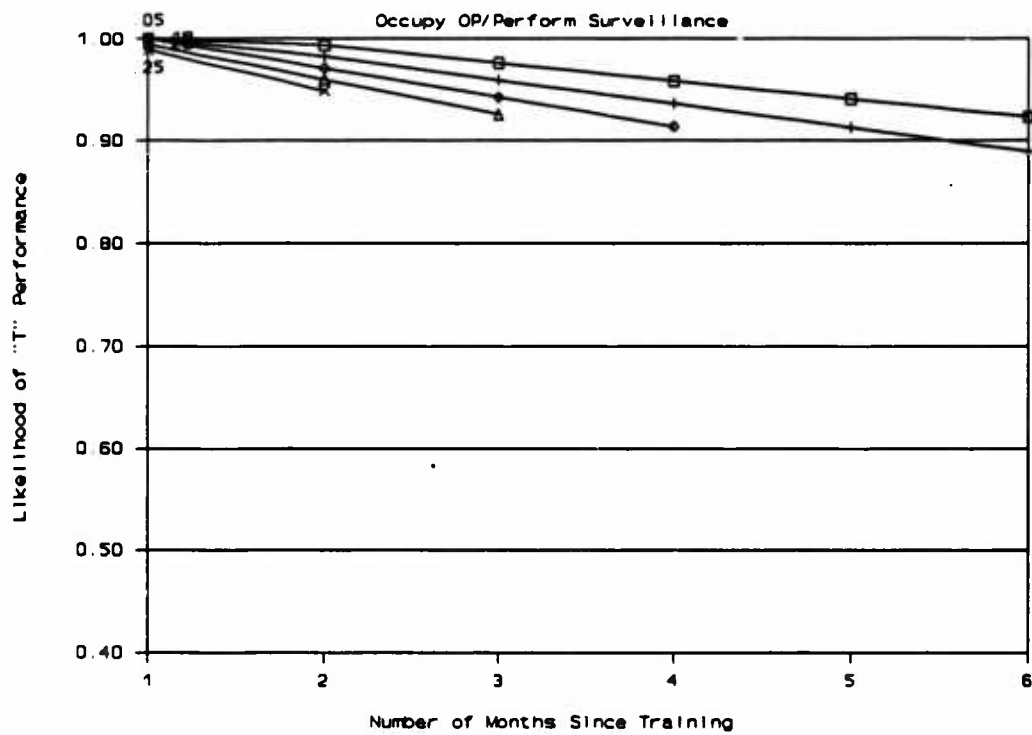
Light Infantry Platoon Tasks



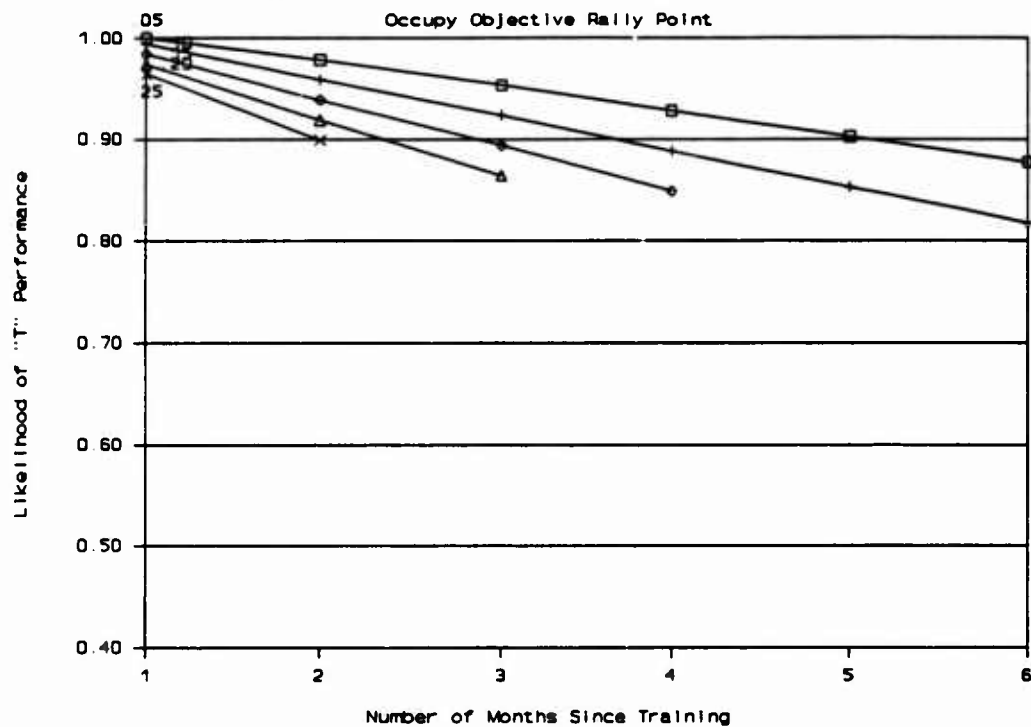
Light Infantry Platoon Tasks



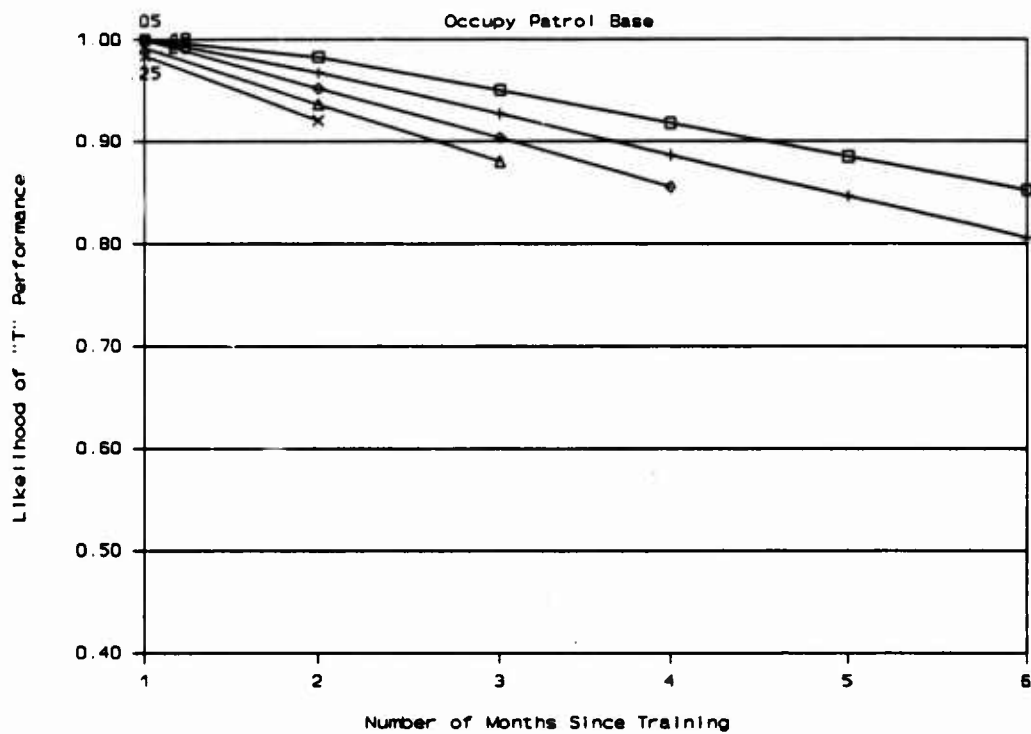
Light Infantry Platoon Tasks



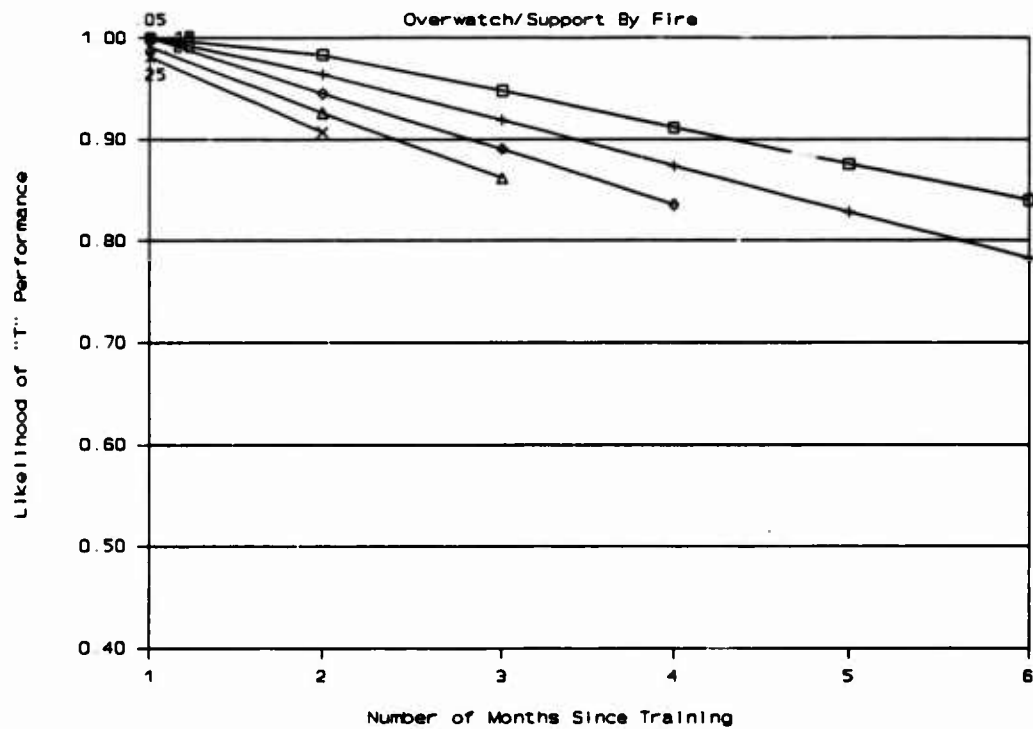
Light Infantry Platoon Tasks



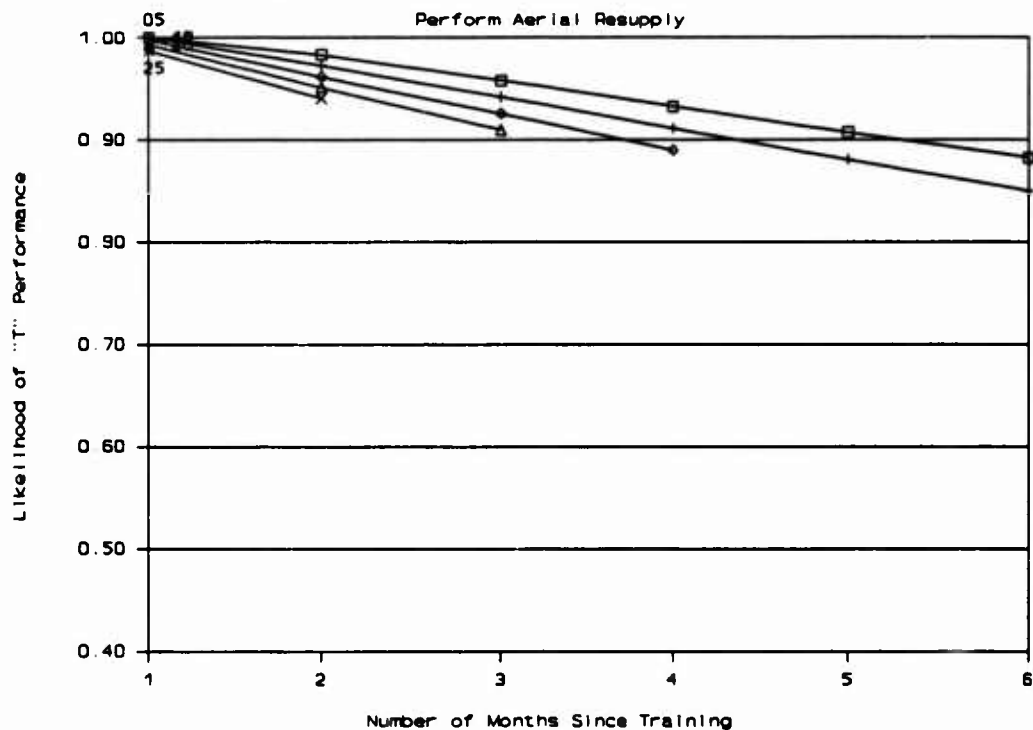
Light Infantry Platoon Tasks



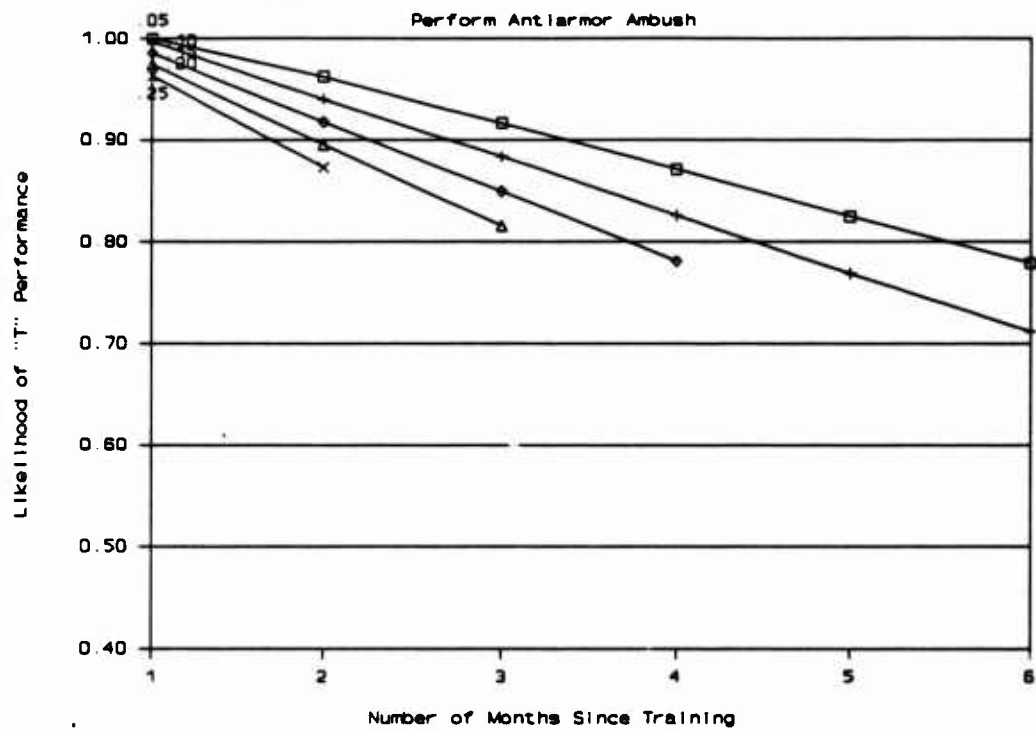
Light Infantry Platoon Tasks



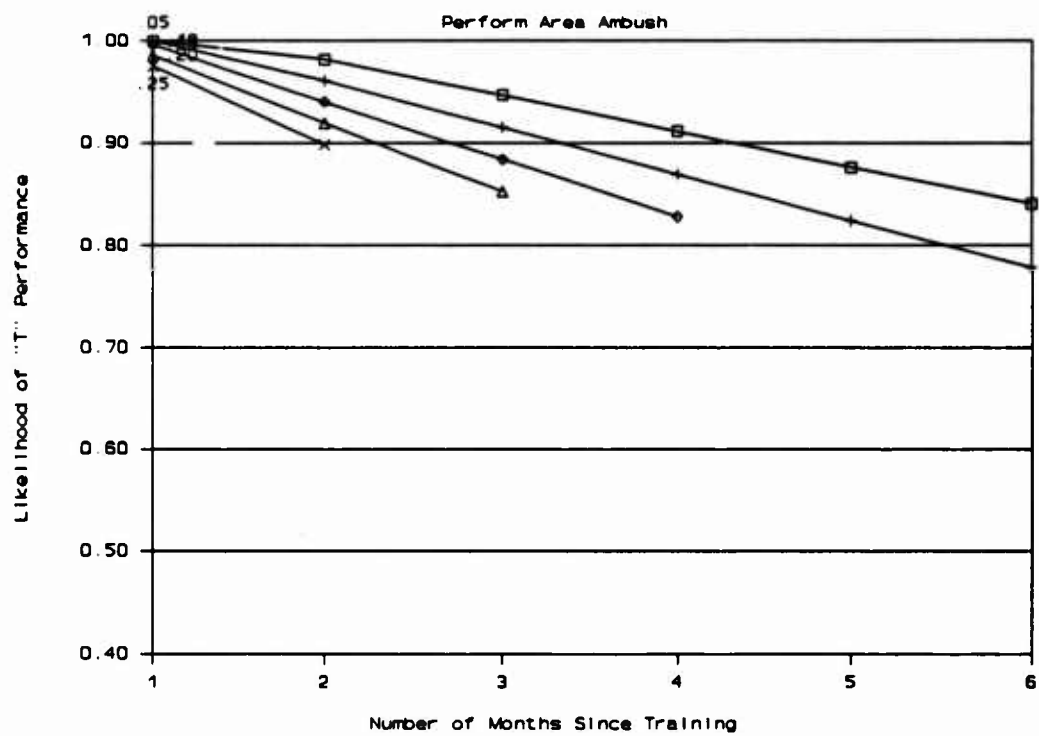
Light Infantry Platoon Tasks



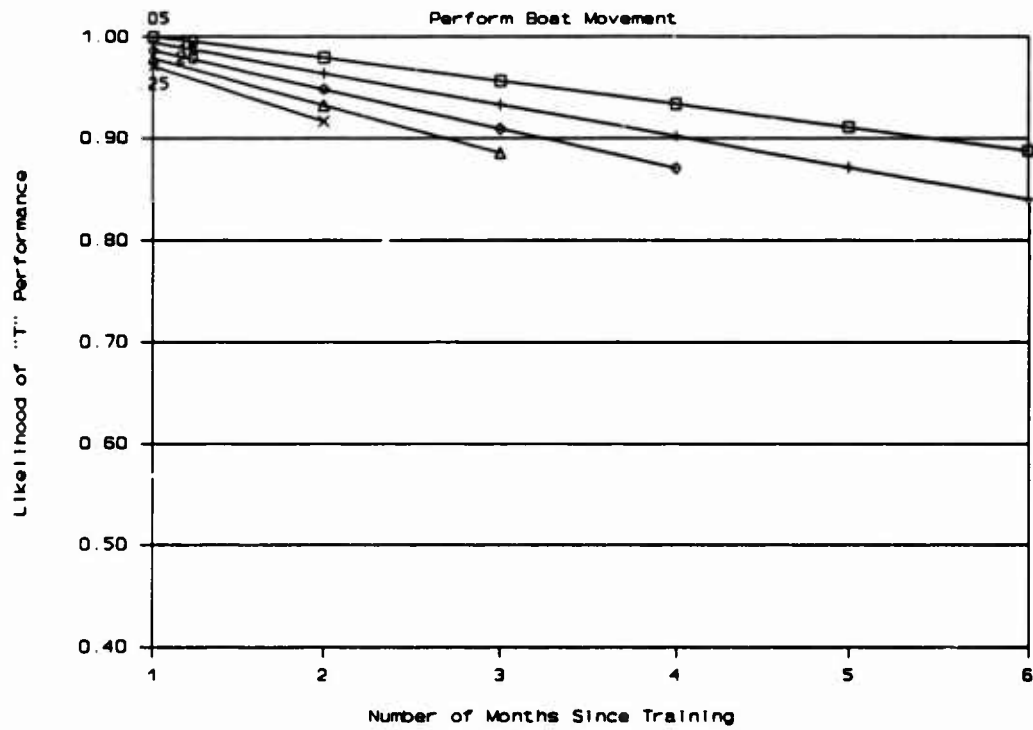
Light Infantry Platoon Tasks



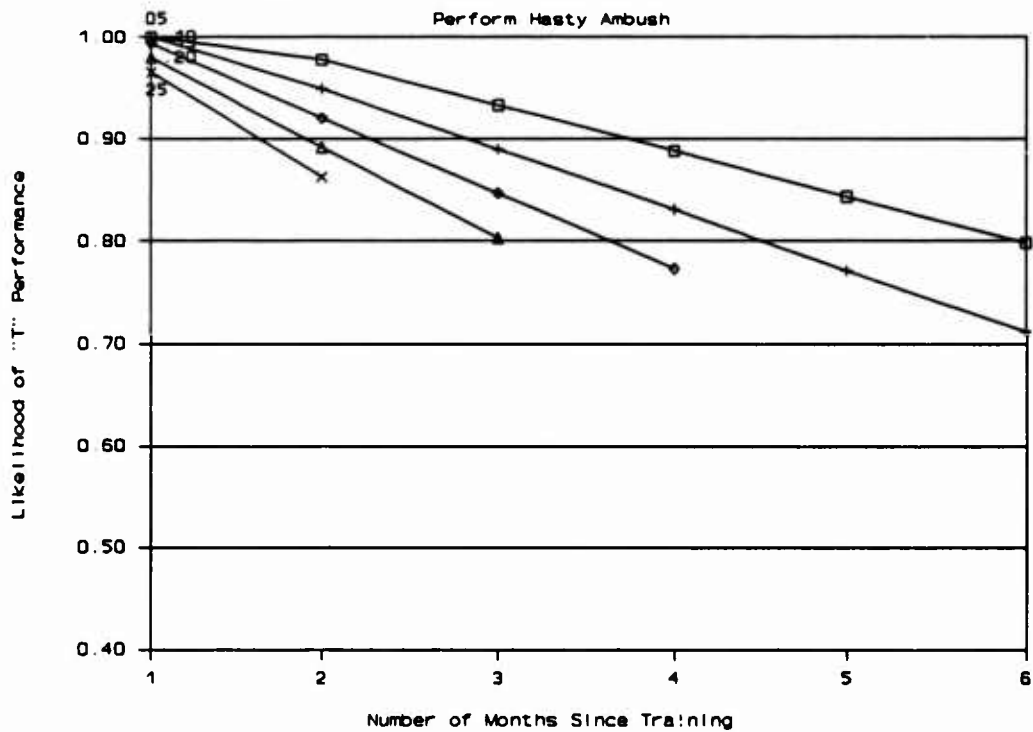
Light Infantry Platoon Tasks



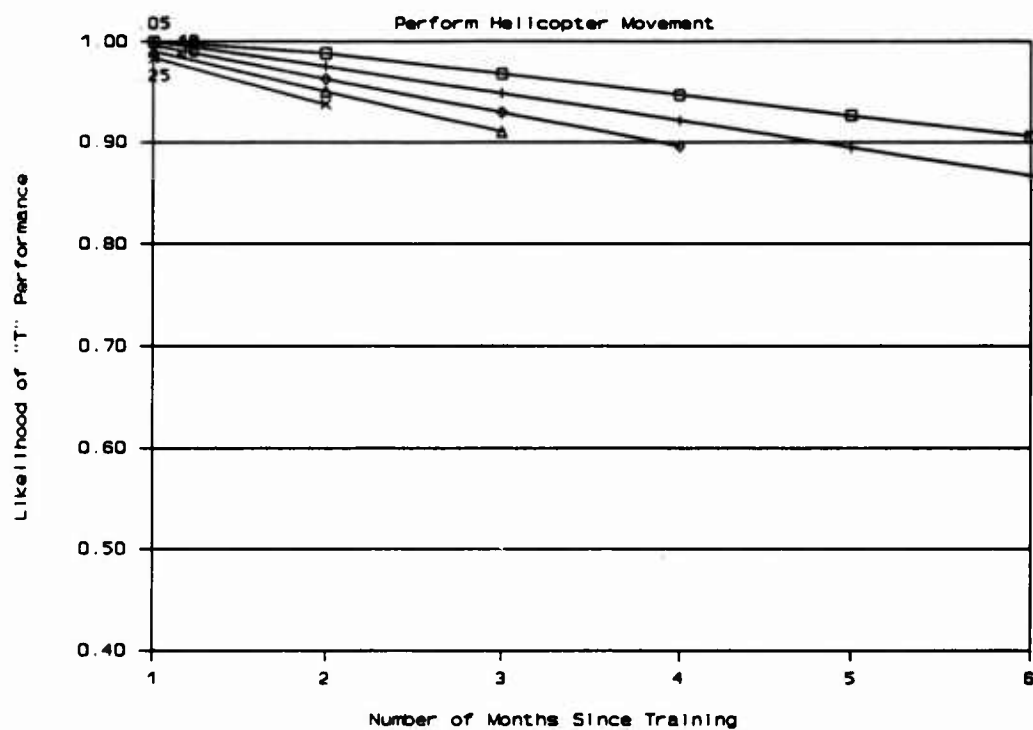
Light Infantry Platoon Tasks



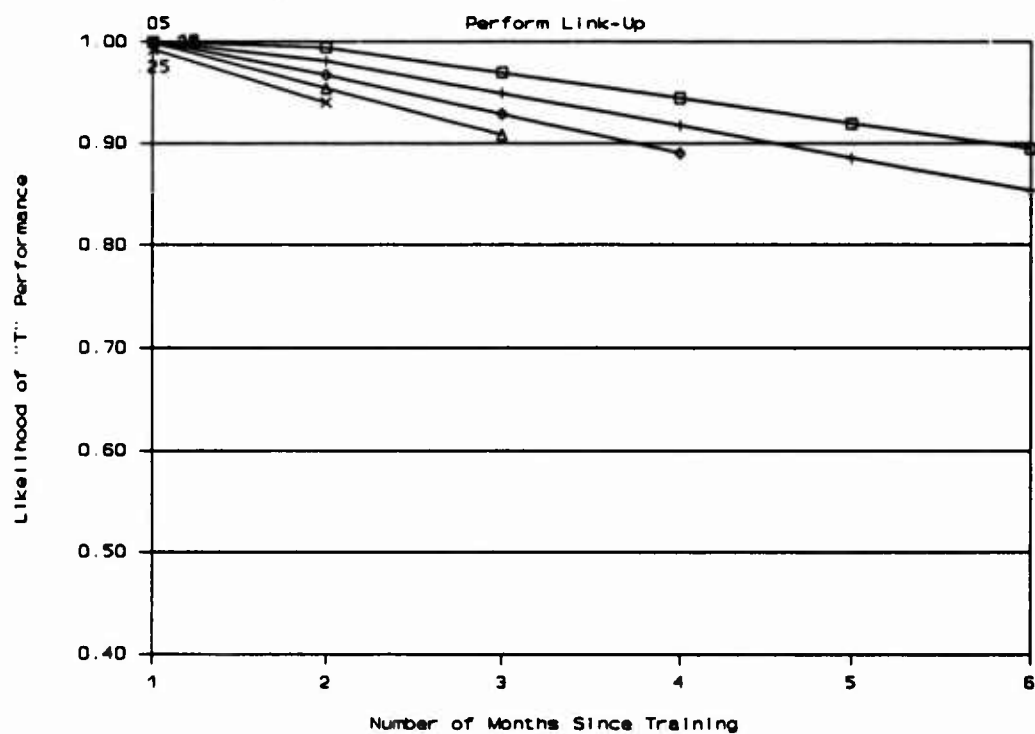
Light Infantry Platoon Tasks



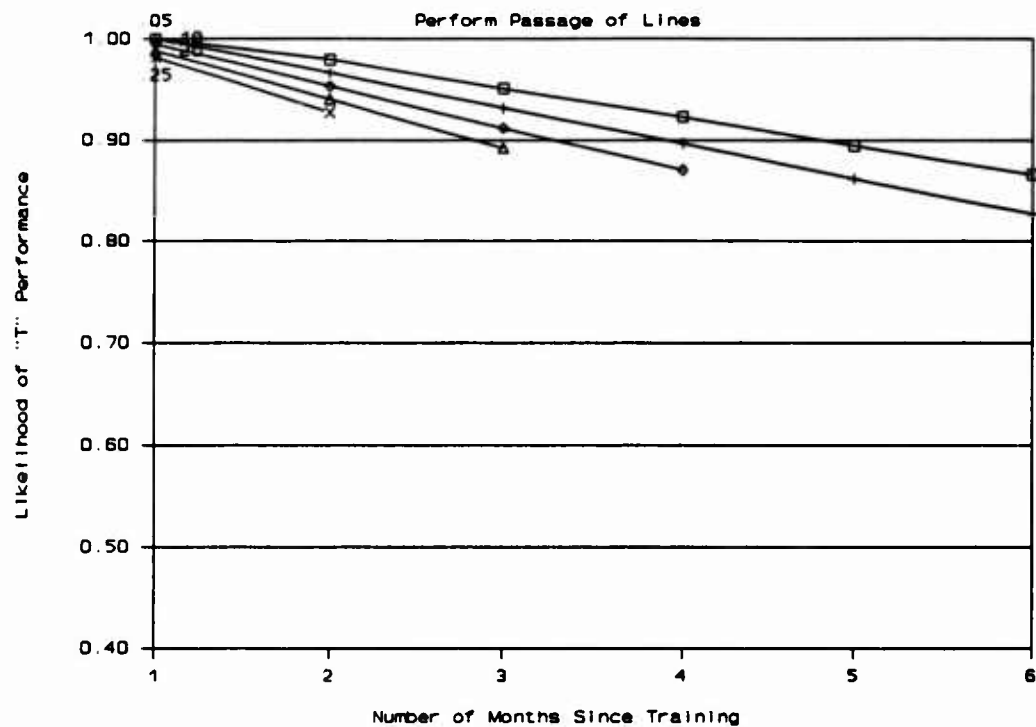
Light Infantry Platoon Tasks



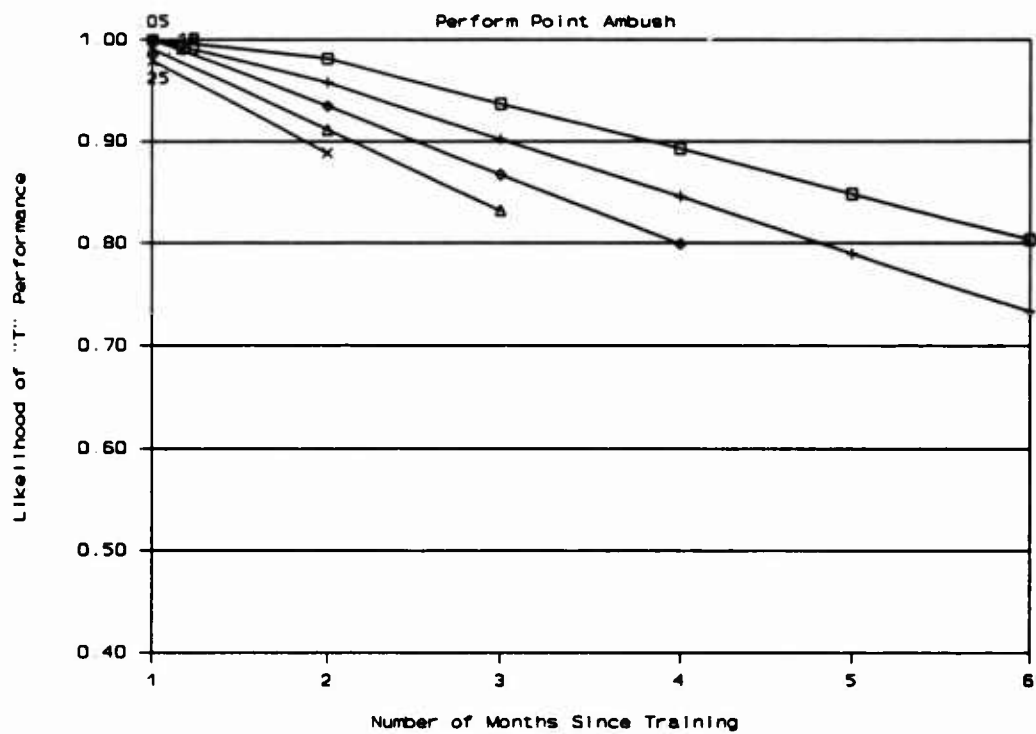
Light Infantry Platoon Tasks



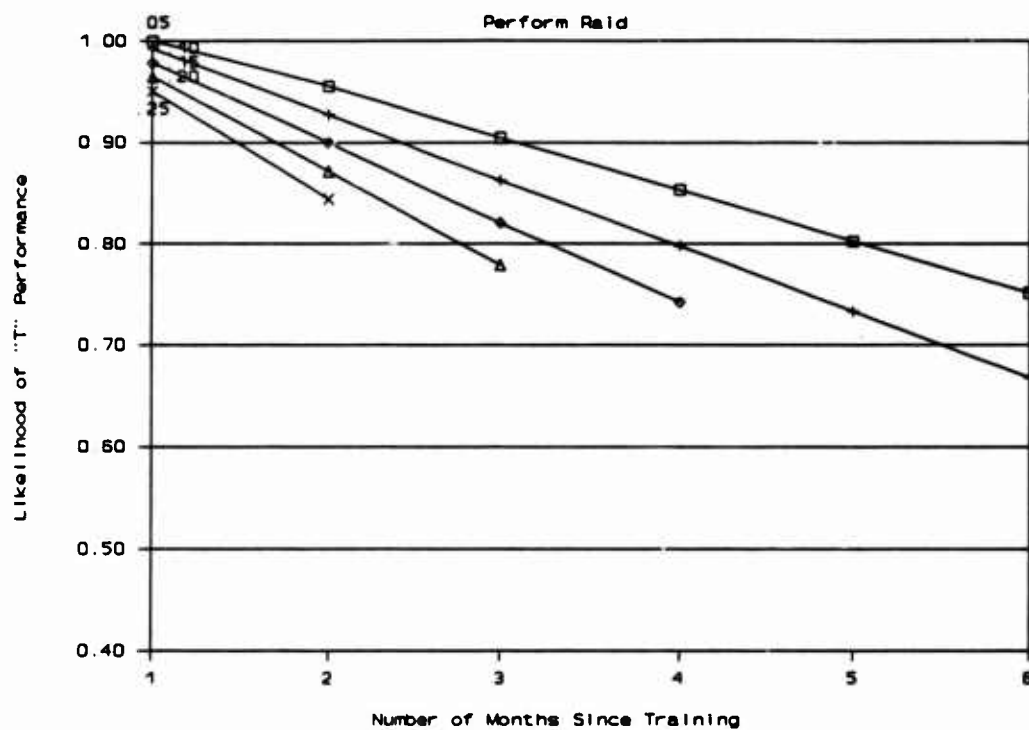
Light Infantry Platoon Tasks



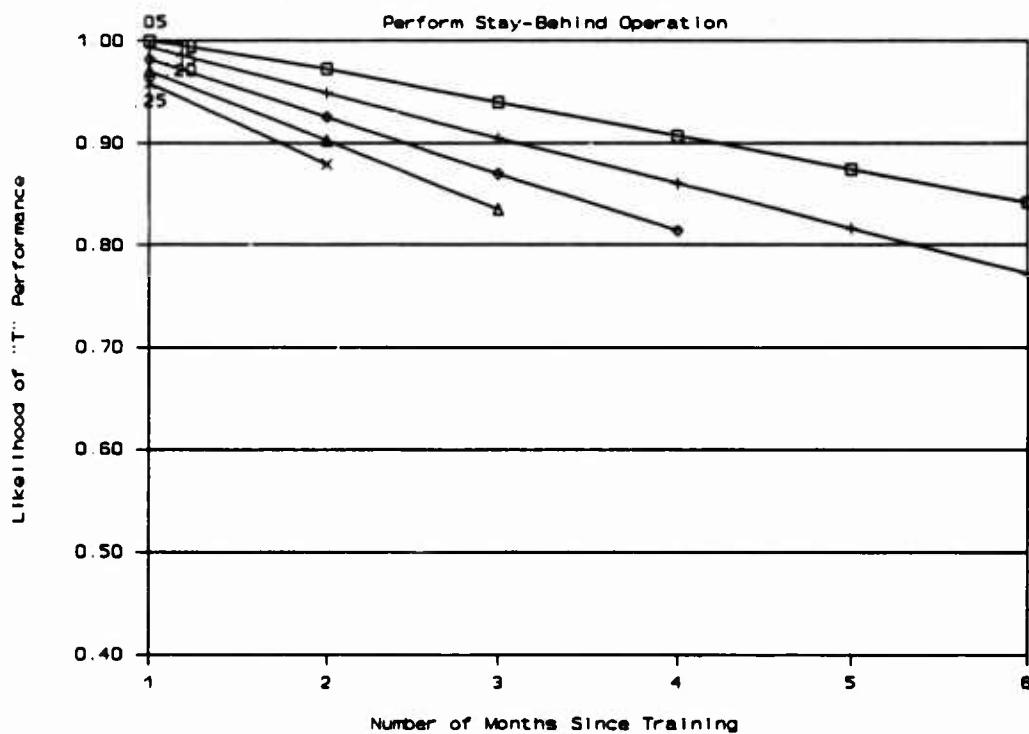
Light Infantry Platoon Tasks



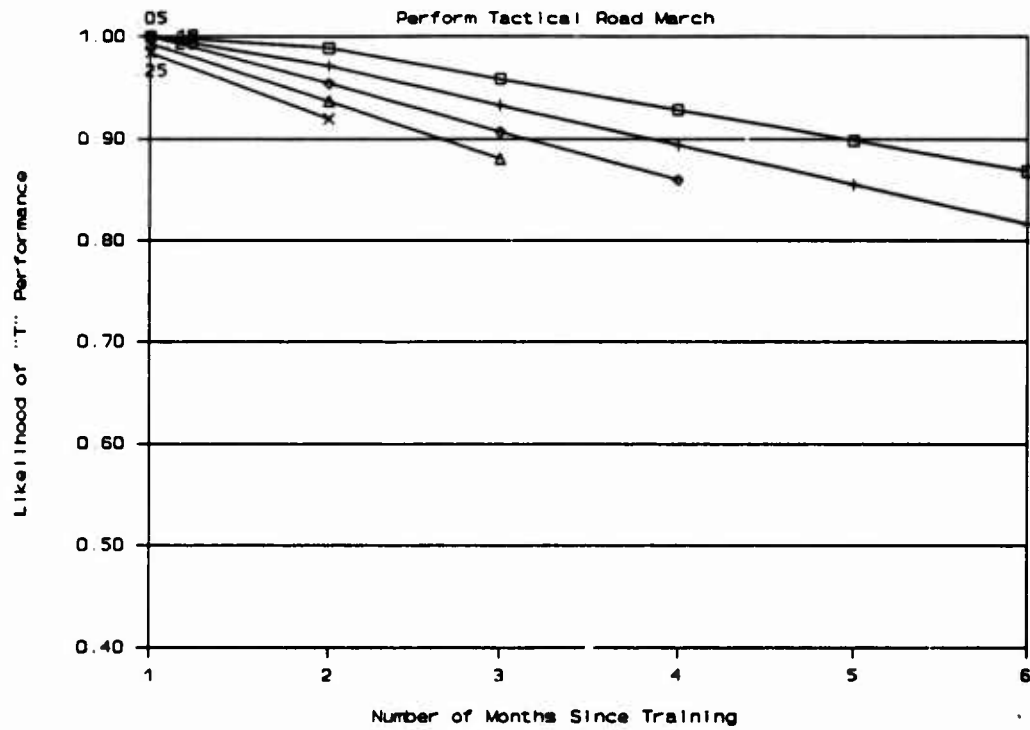
Light Infantry Platoon Tasks



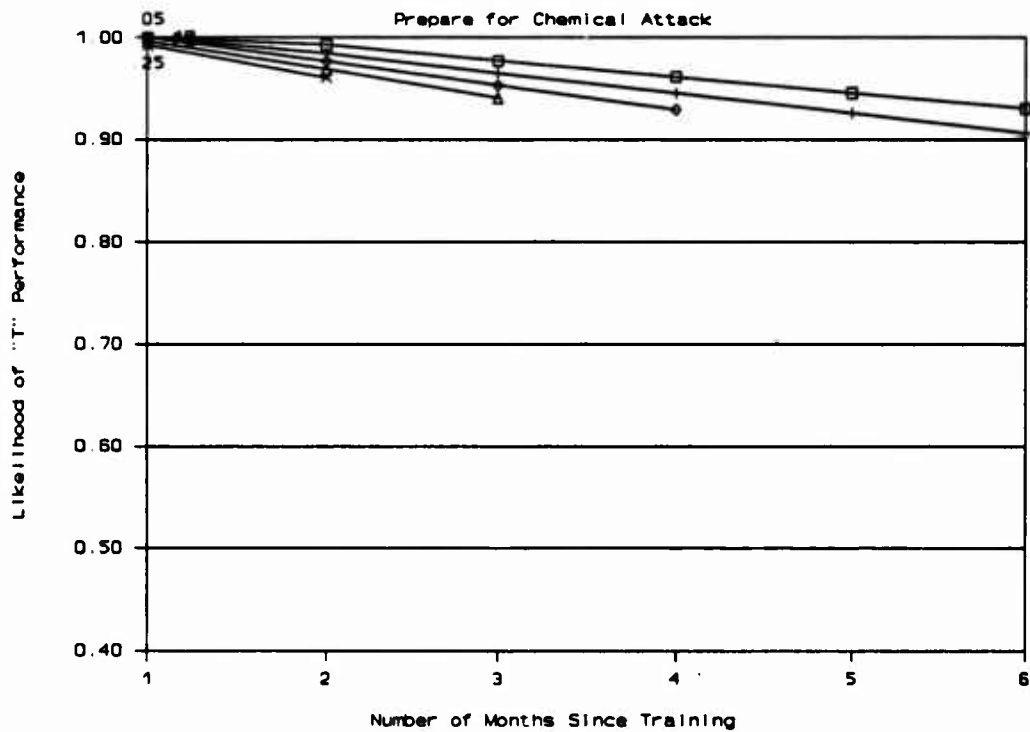
Light Infantry Platoon Tasks



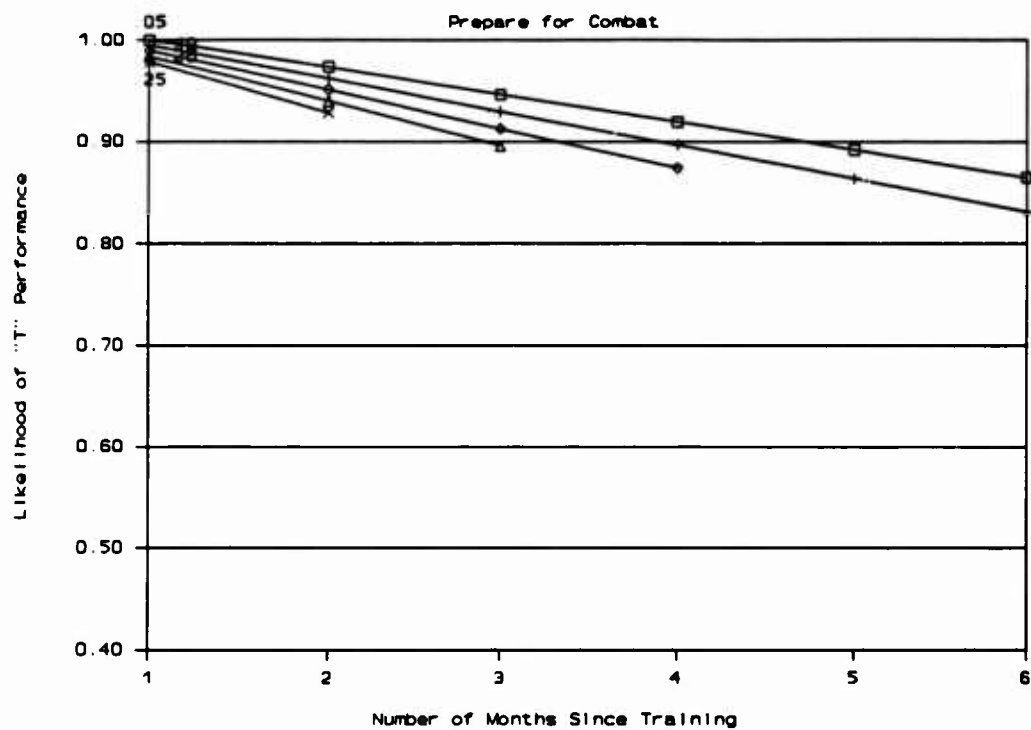
Light Infantry Platoon Tasks



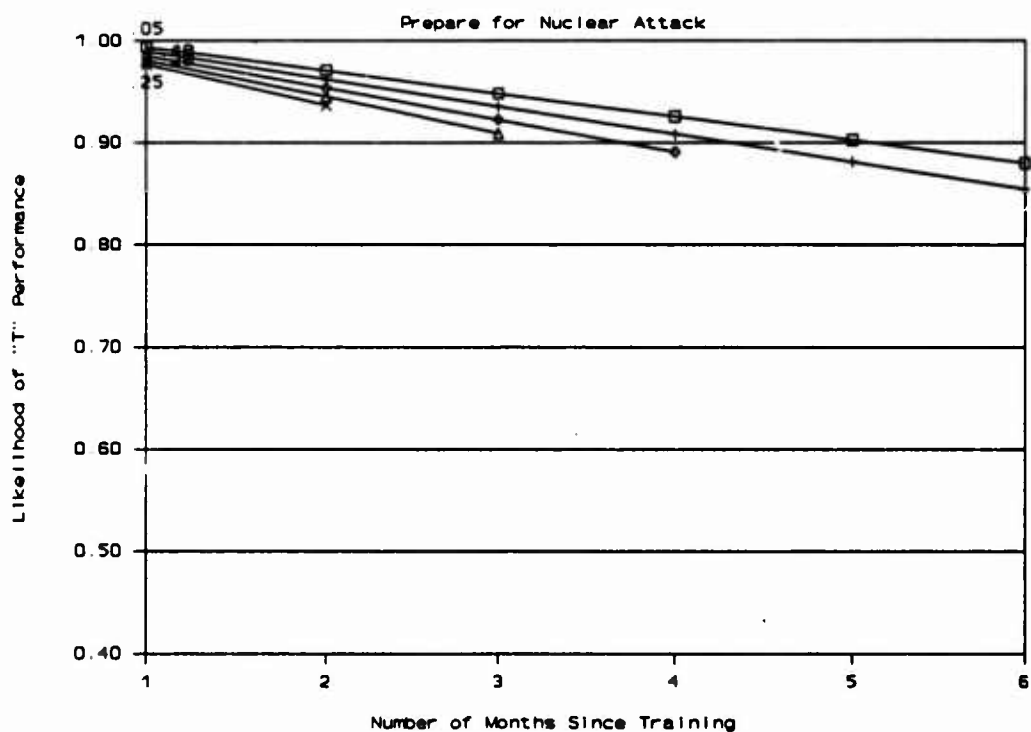
Light Infantry Platoon Tasks



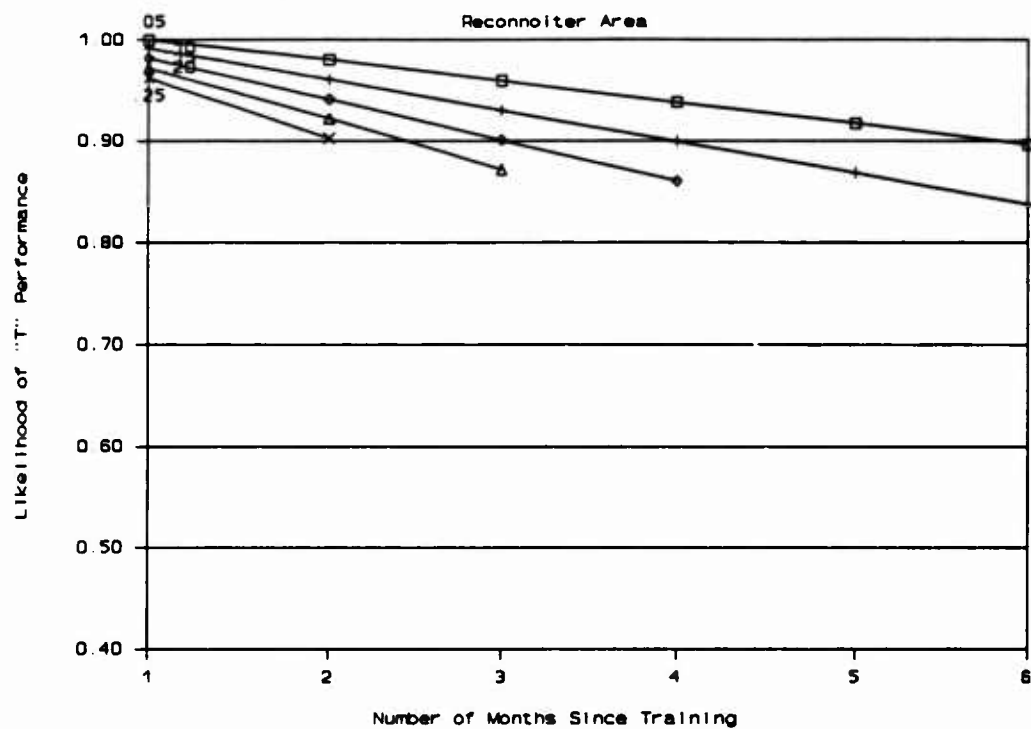
Light Infantry Platoon Tasks



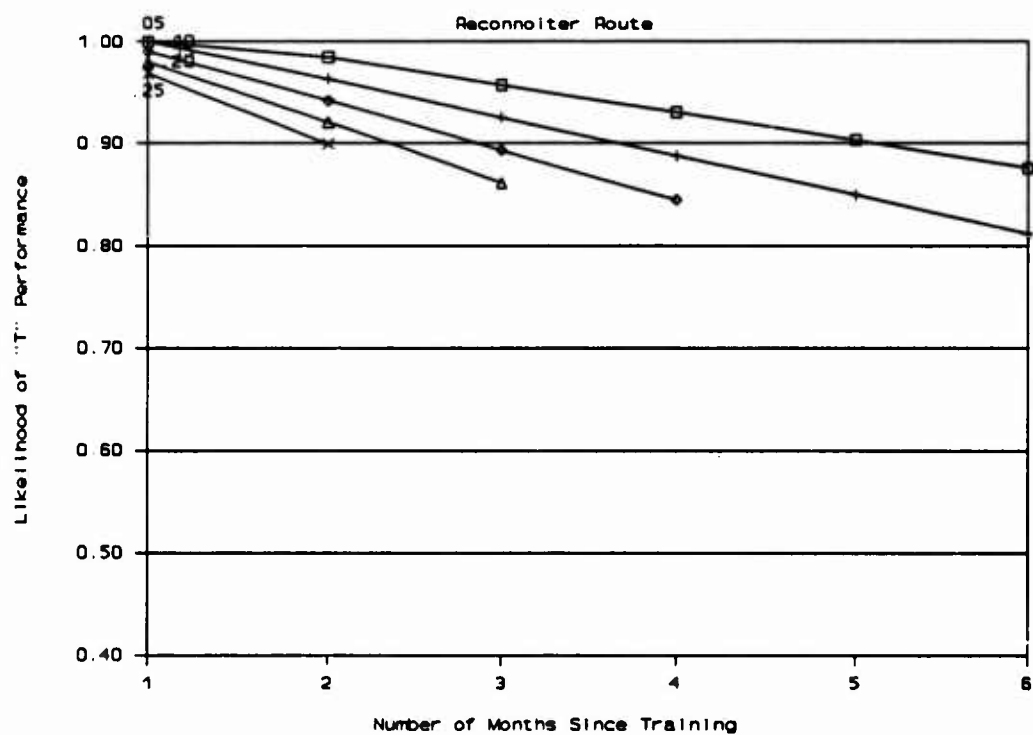
Light Infantry Platoon Tasks



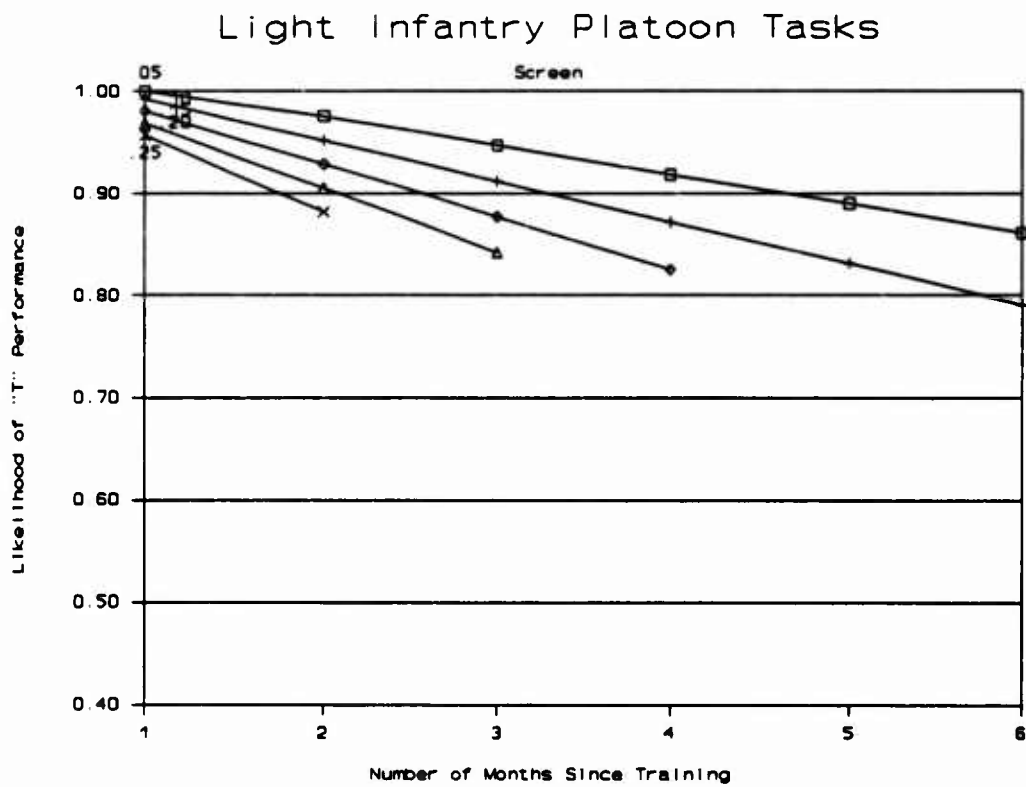
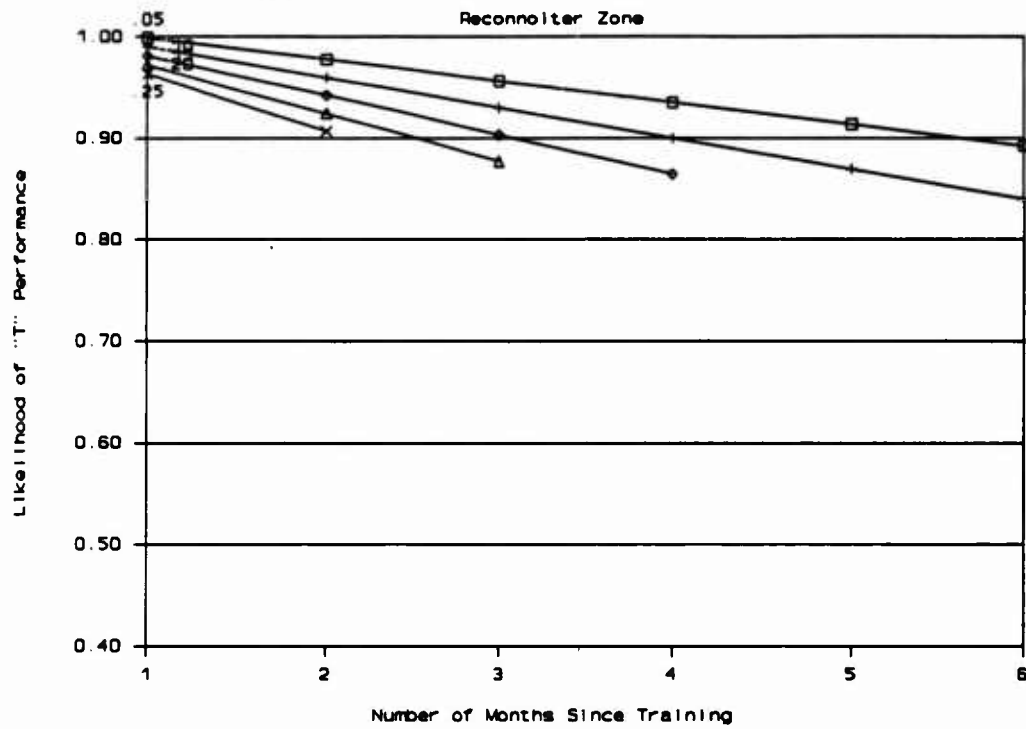
Light Infantry Platoon Tasks



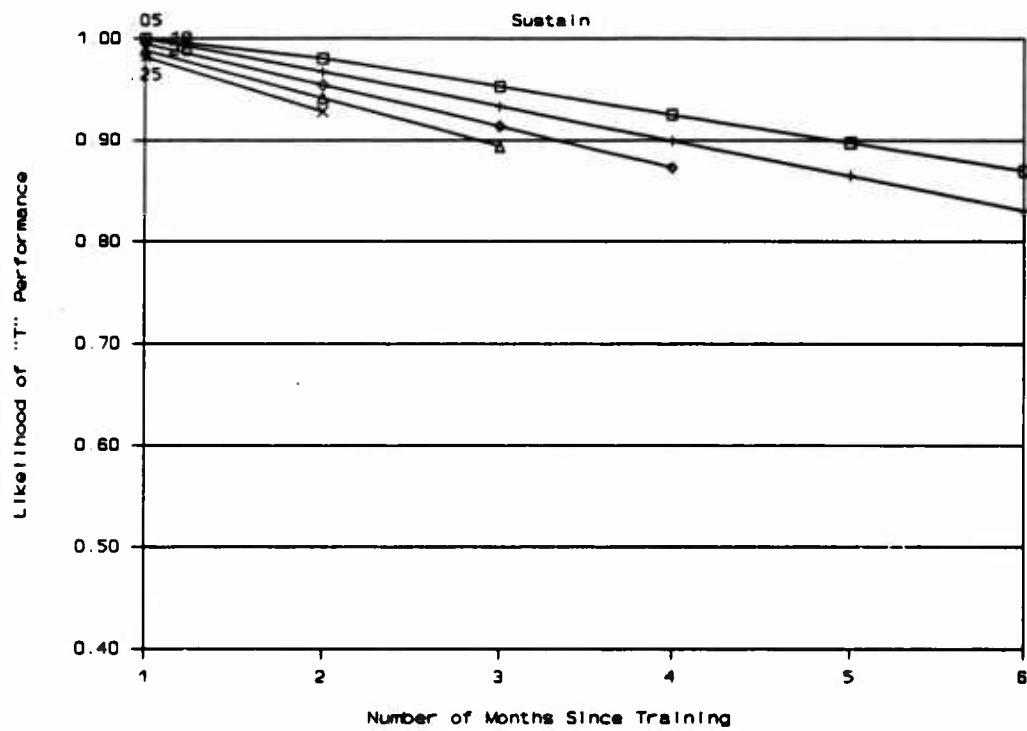
Light Infantry Platoon Tasks



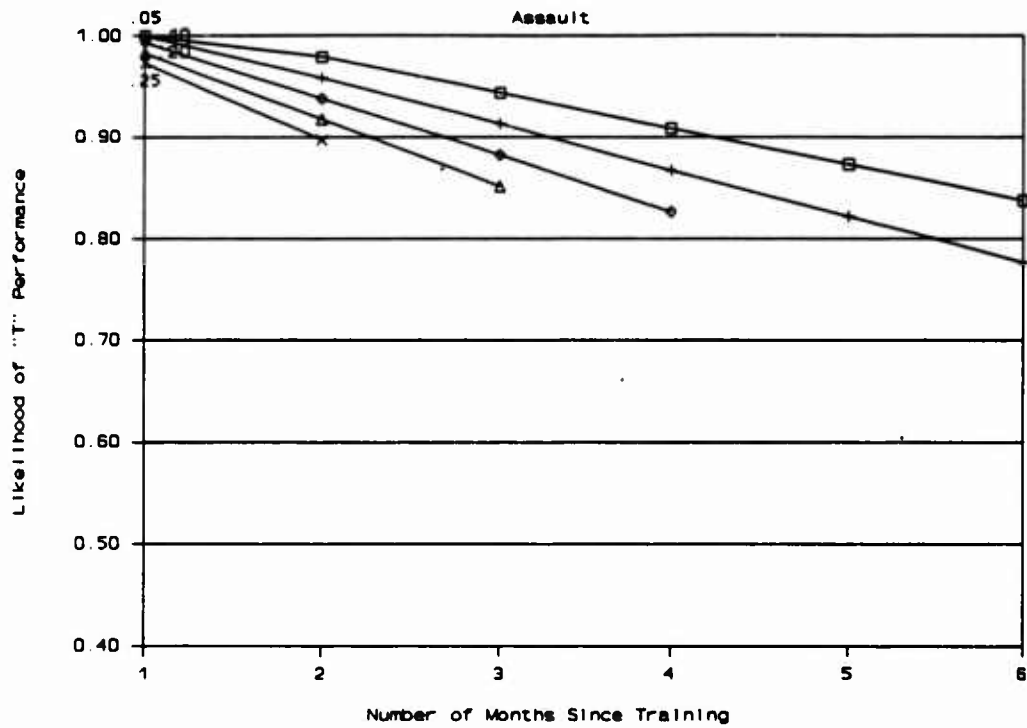
Light Infantry Platoon Tasks



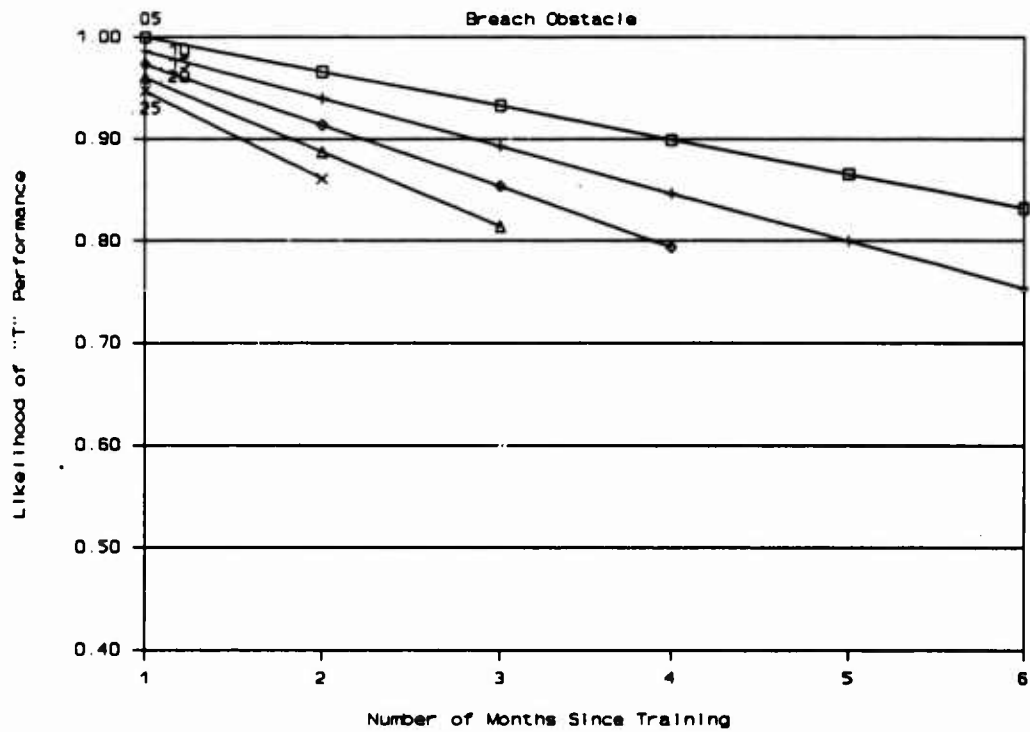
Light Infantry Platoon Tasks



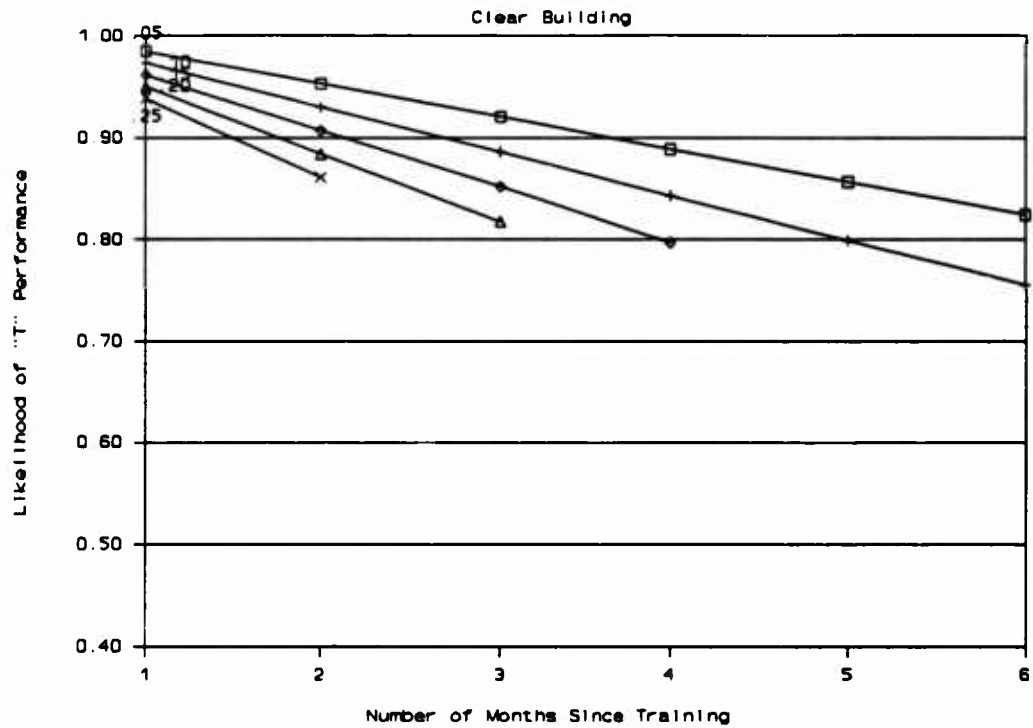
Light Infantry Squad Tasks



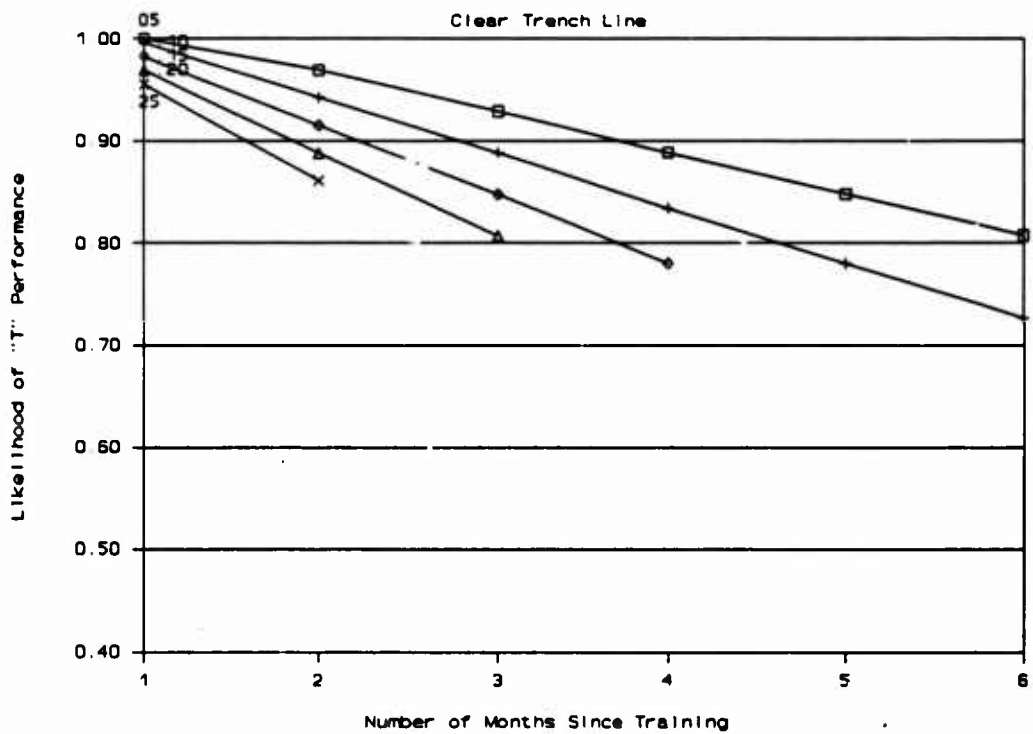
Light Infantry Squad Tasks



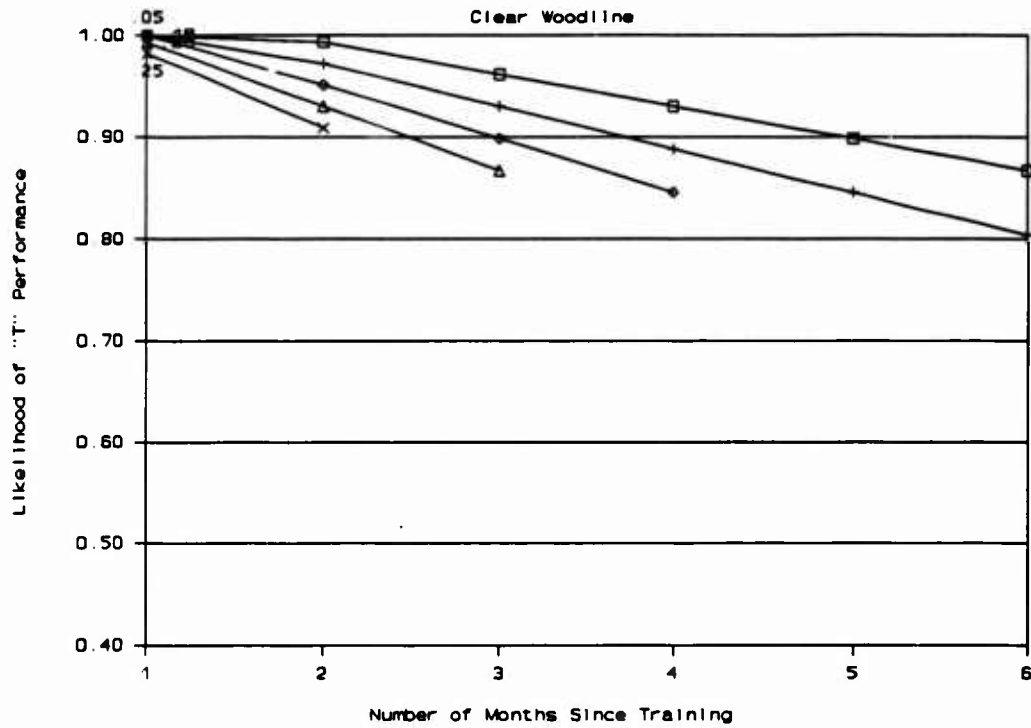
Light Infantry Squad Tasks



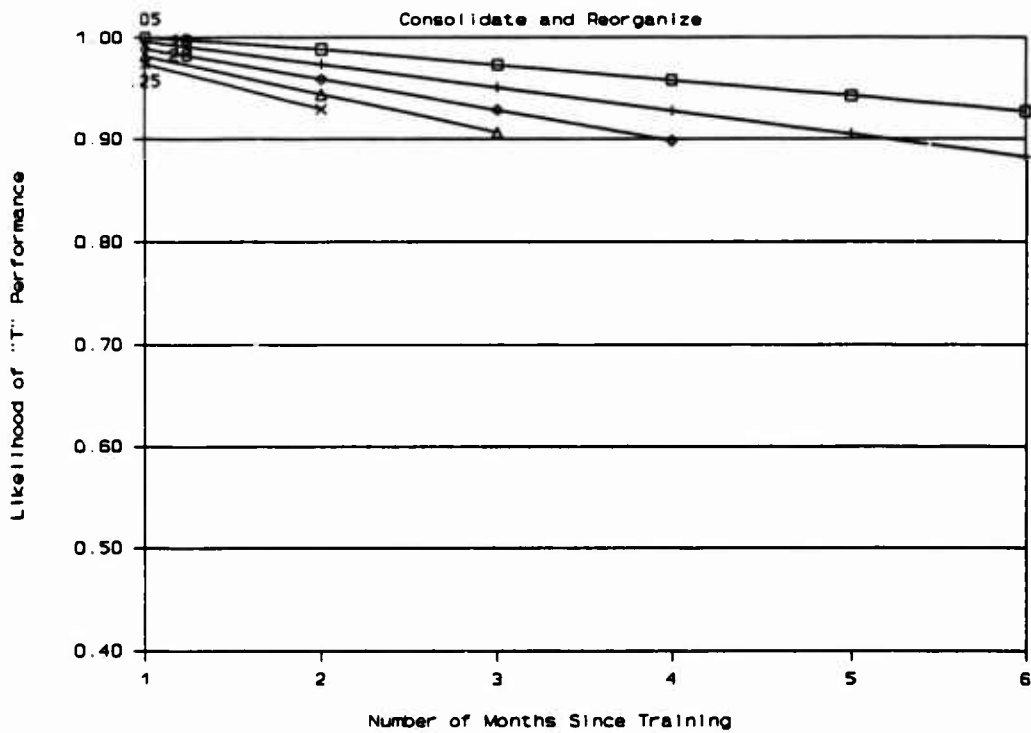
Light Infantry Squad Tasks



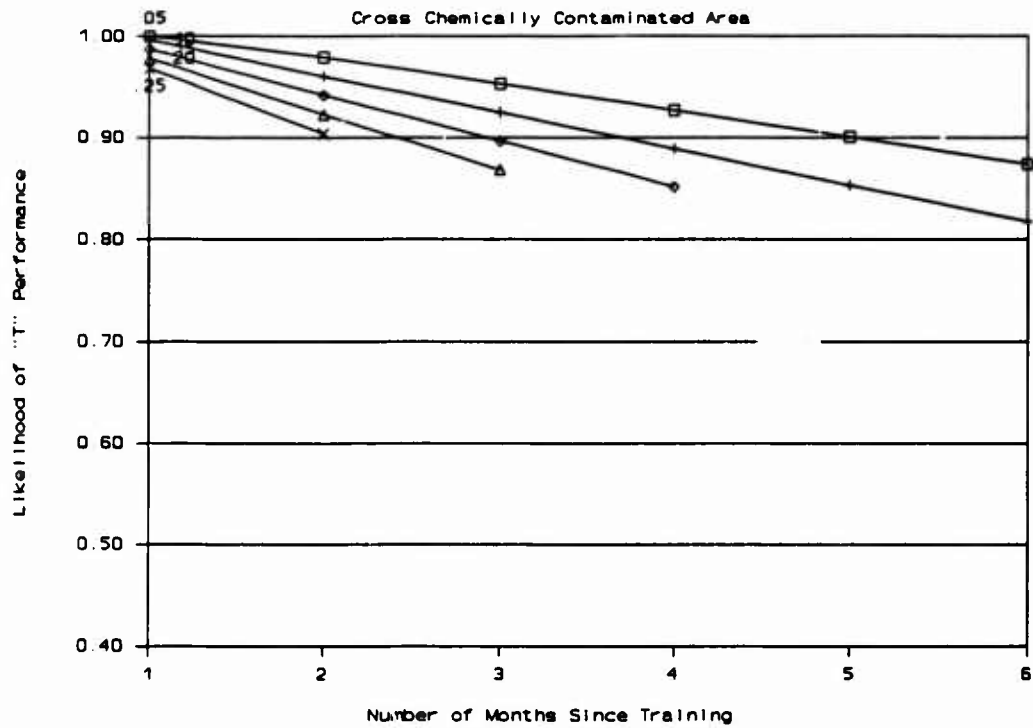
Light Infantry Squad Tasks



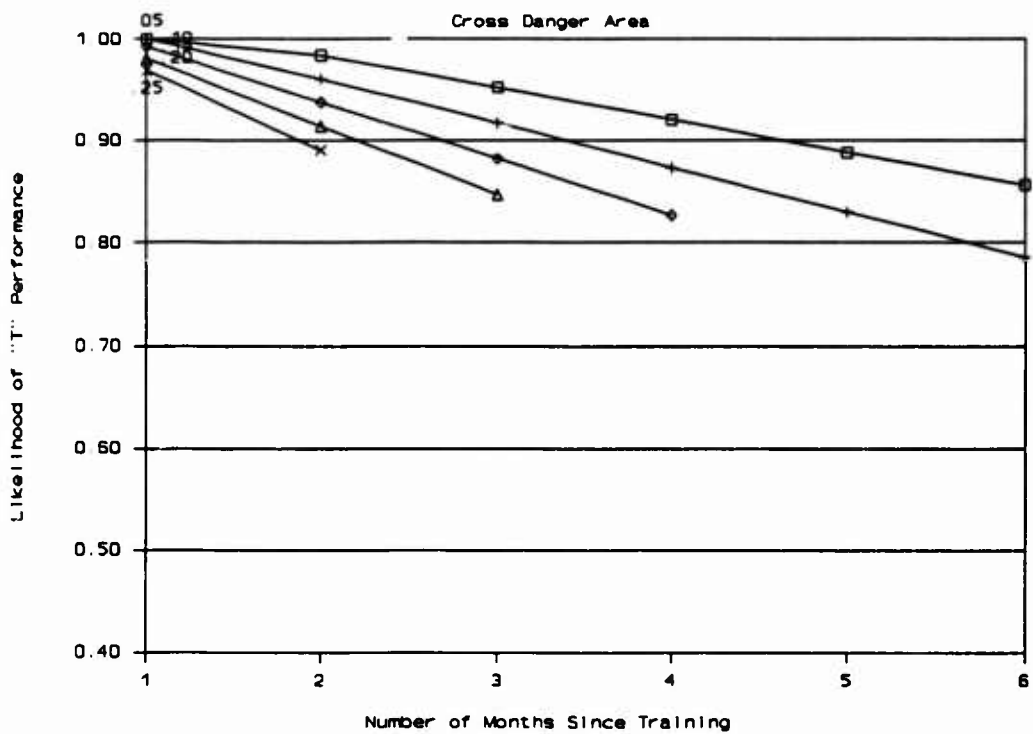
Light Infantry Squad Tasks



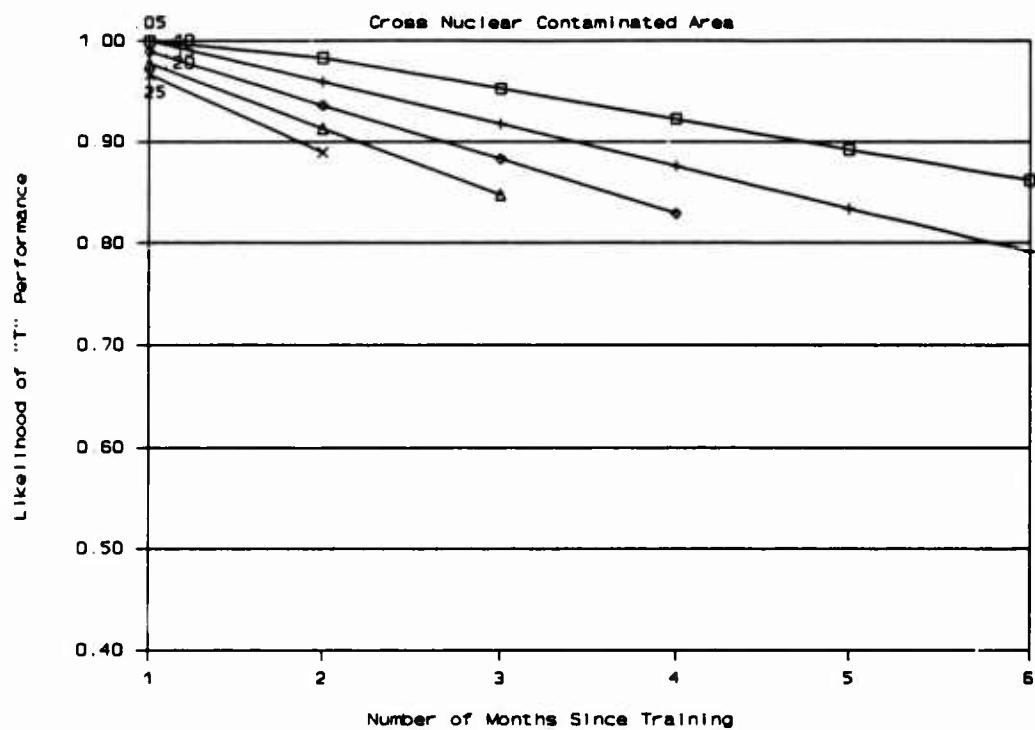
Light Infantry Squad Tasks



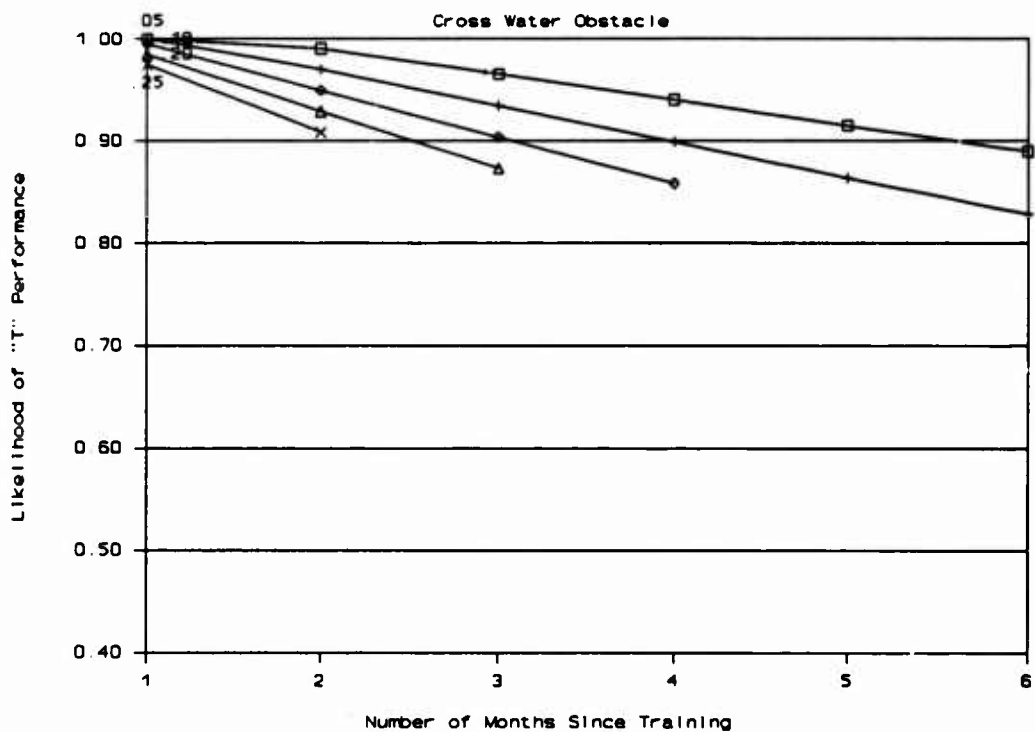
Light Infantry Squad Tasks



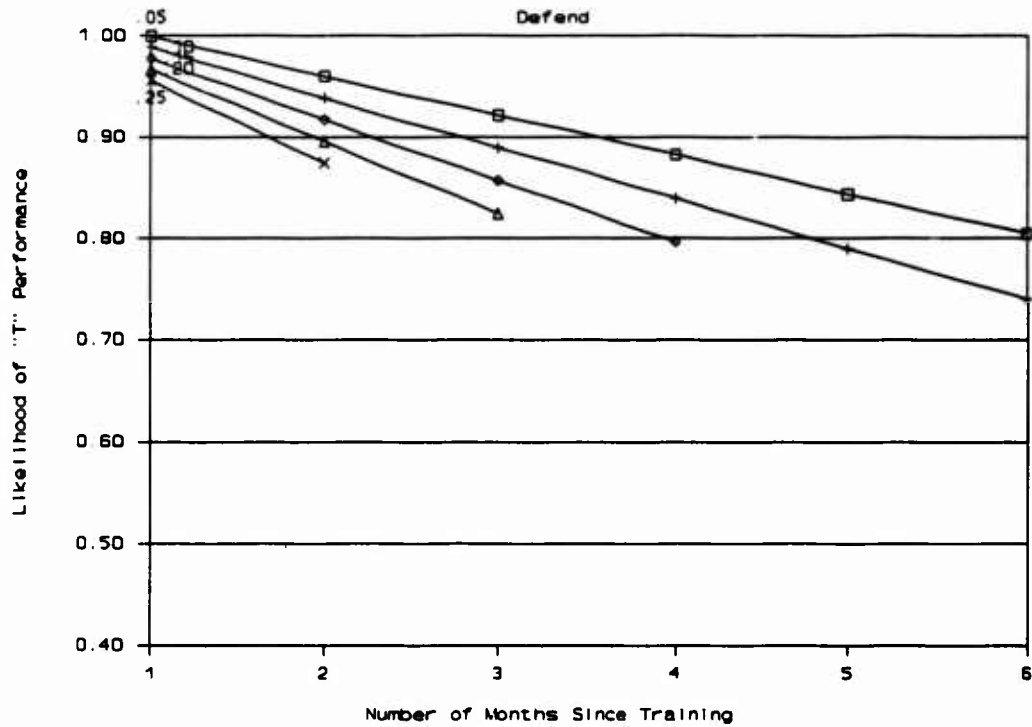
Light Infantry Squad Tasks



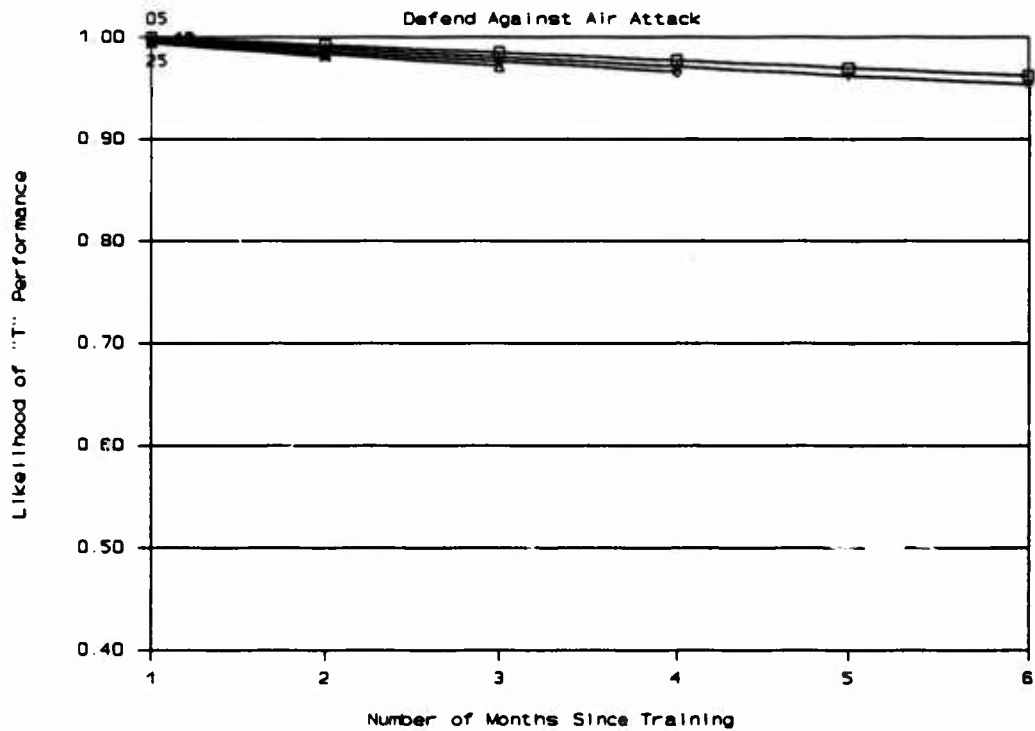
Light Infantry Squad Tasks



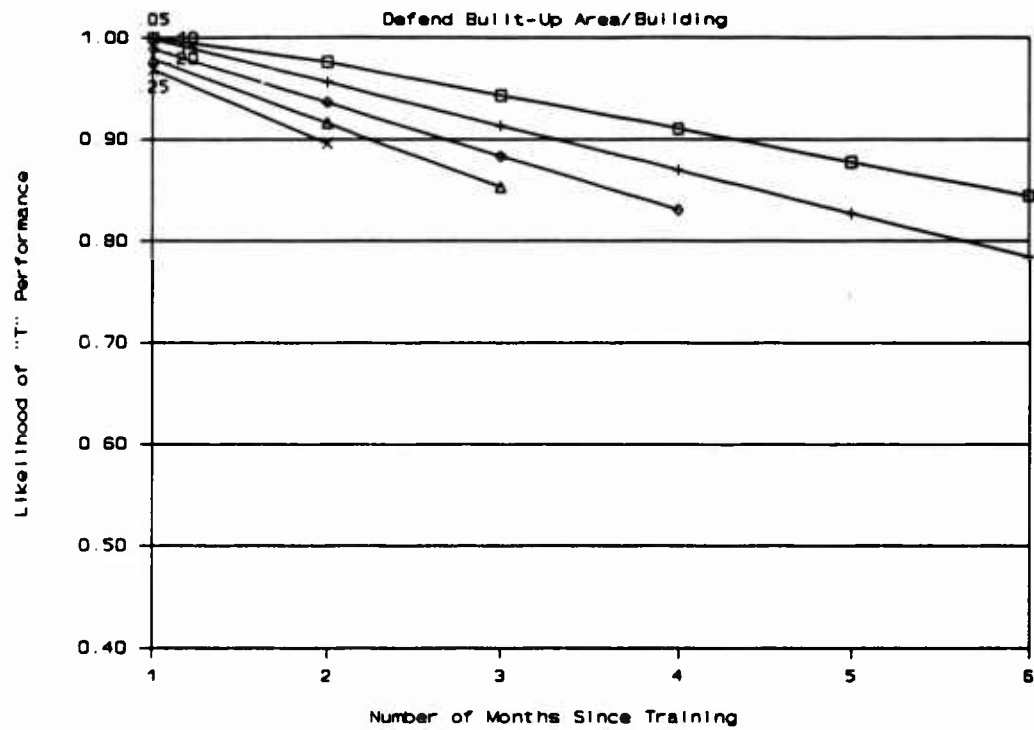
Light Infantry Squad Tasks



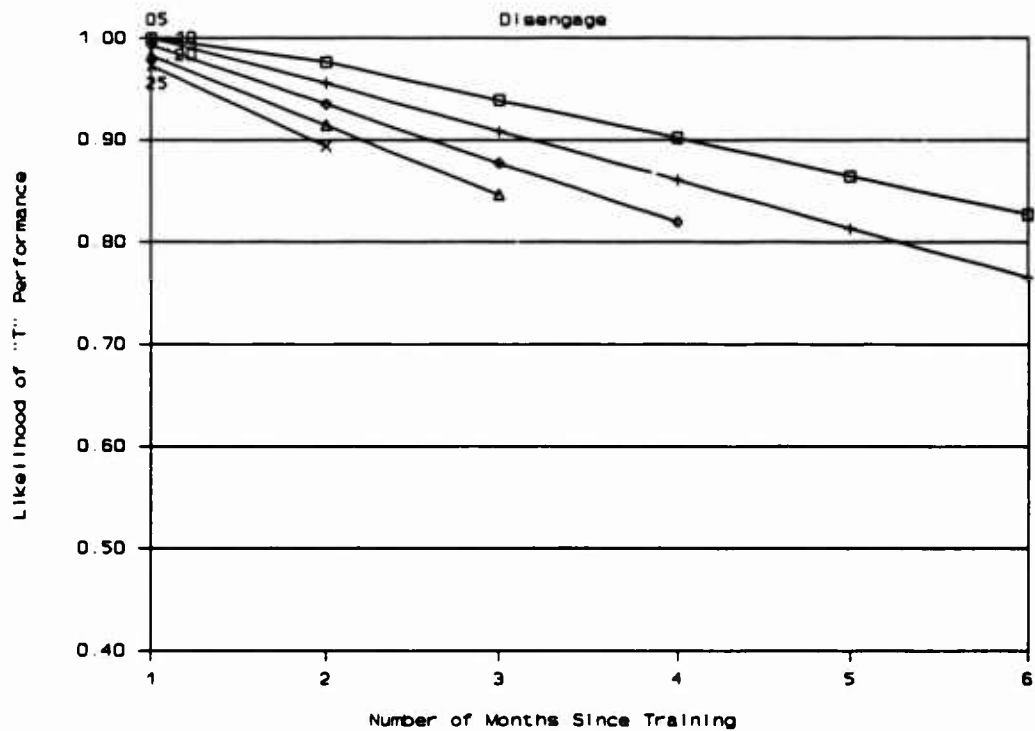
Light Infantry Squad Tasks



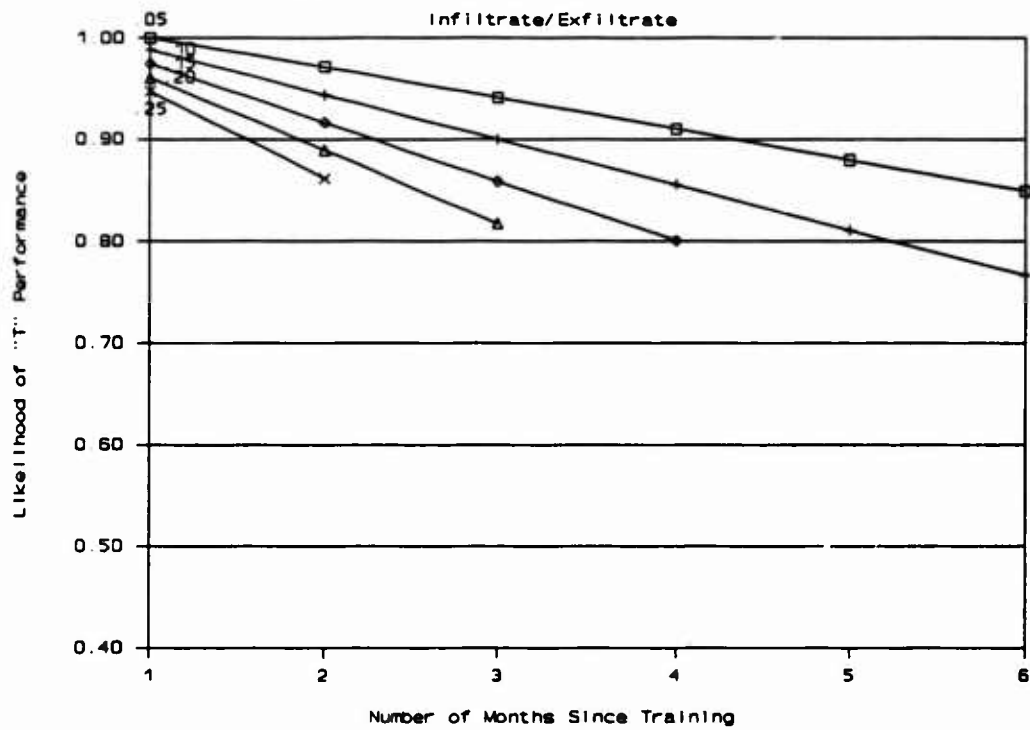
Light Infantry Squad Tasks



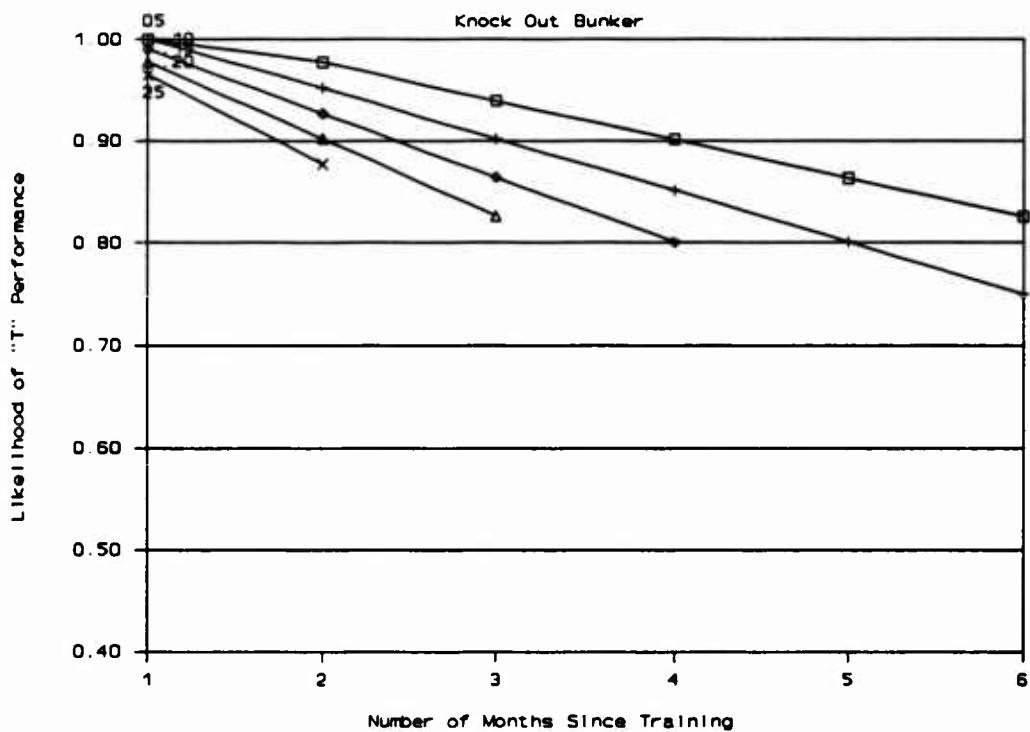
Light Infantry Squad Tasks



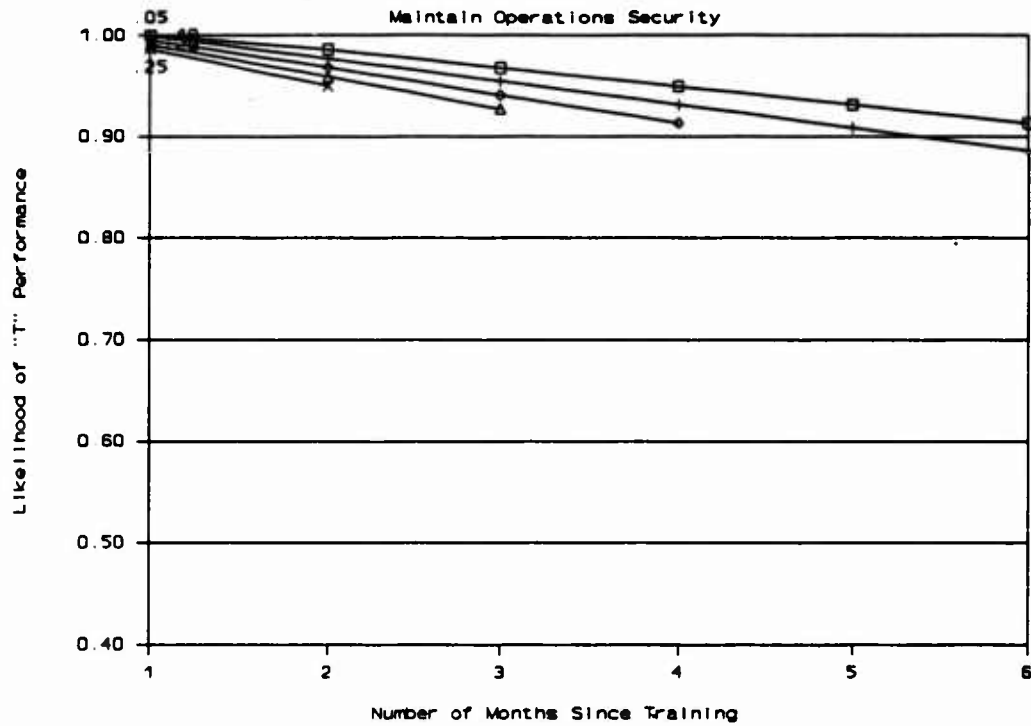
Light Infantry Squad Tasks



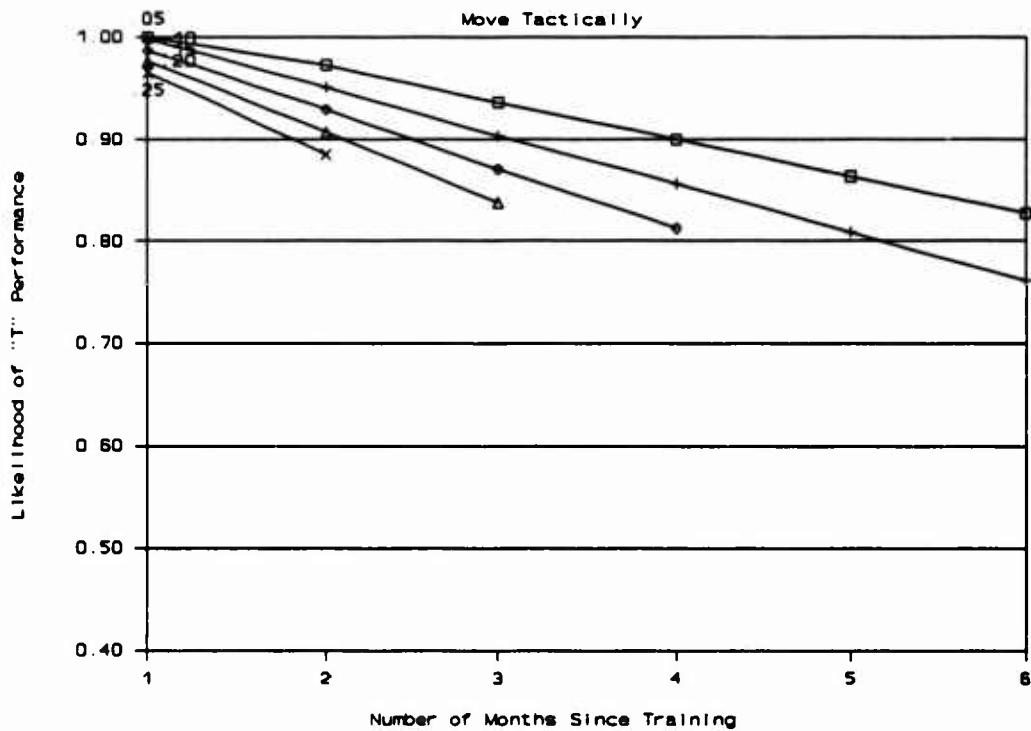
Light Infantry Squad Tasks



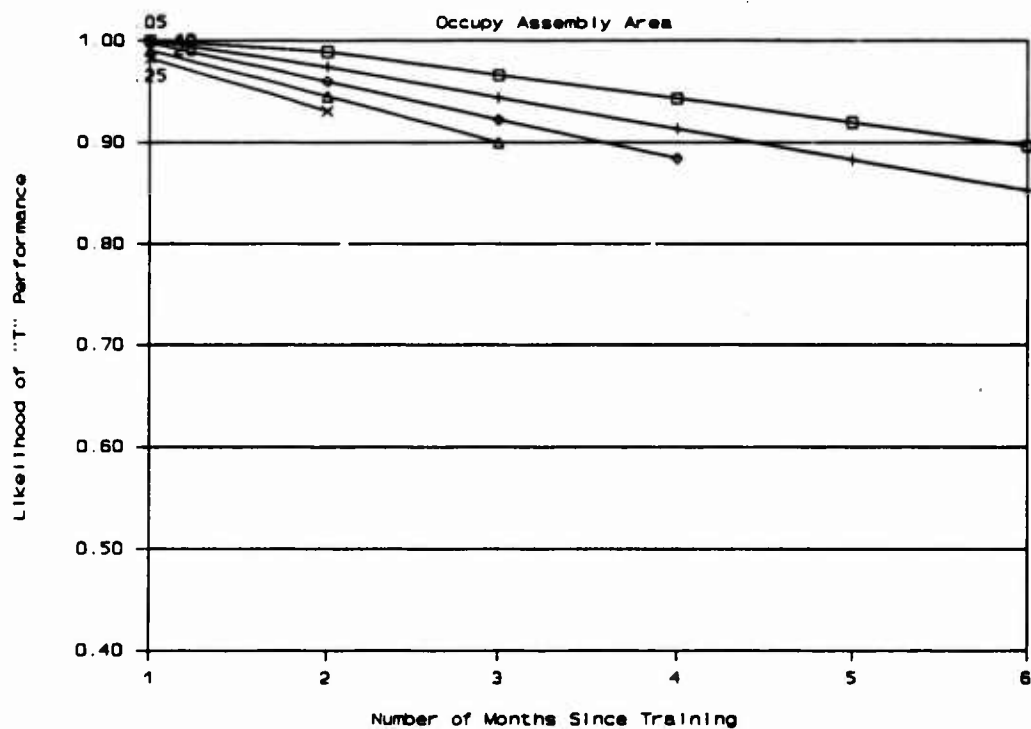
Light Infantry Squad Tasks



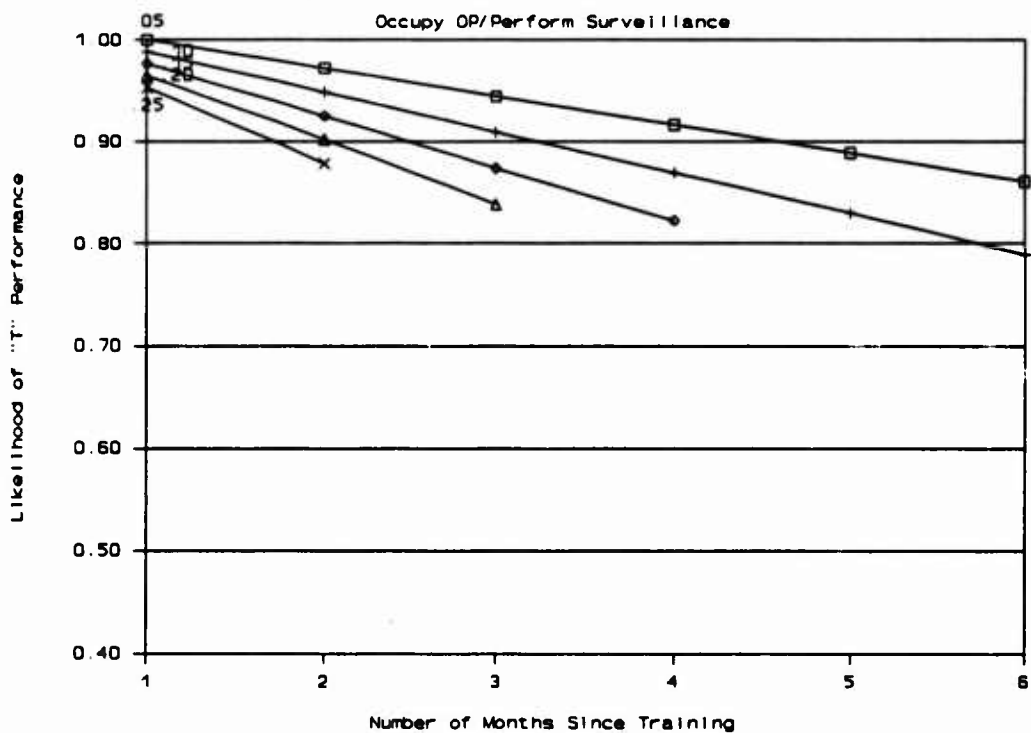
Light Infantry Squad Tasks



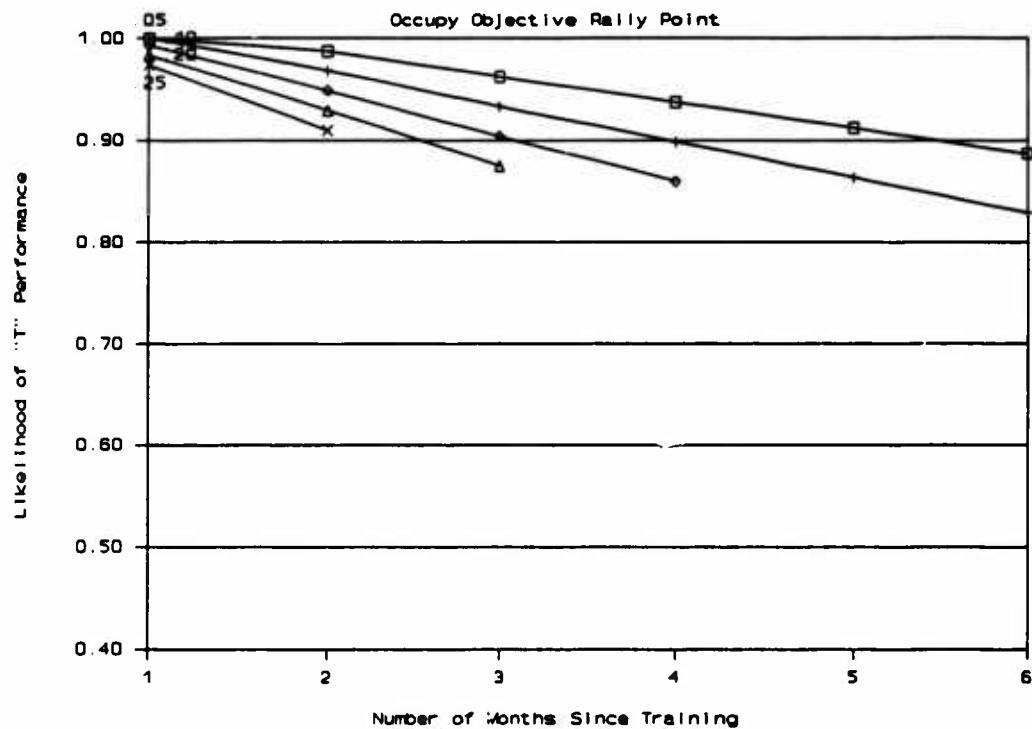
Light Infantry Squad Tasks



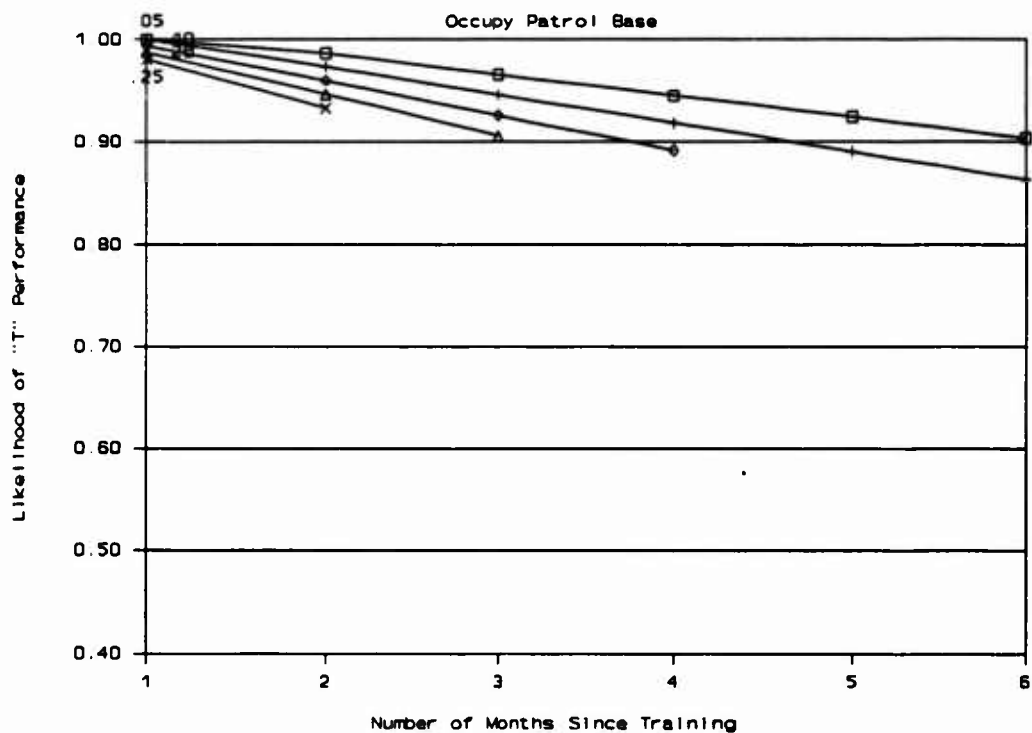
Light Infantry Squad Tasks



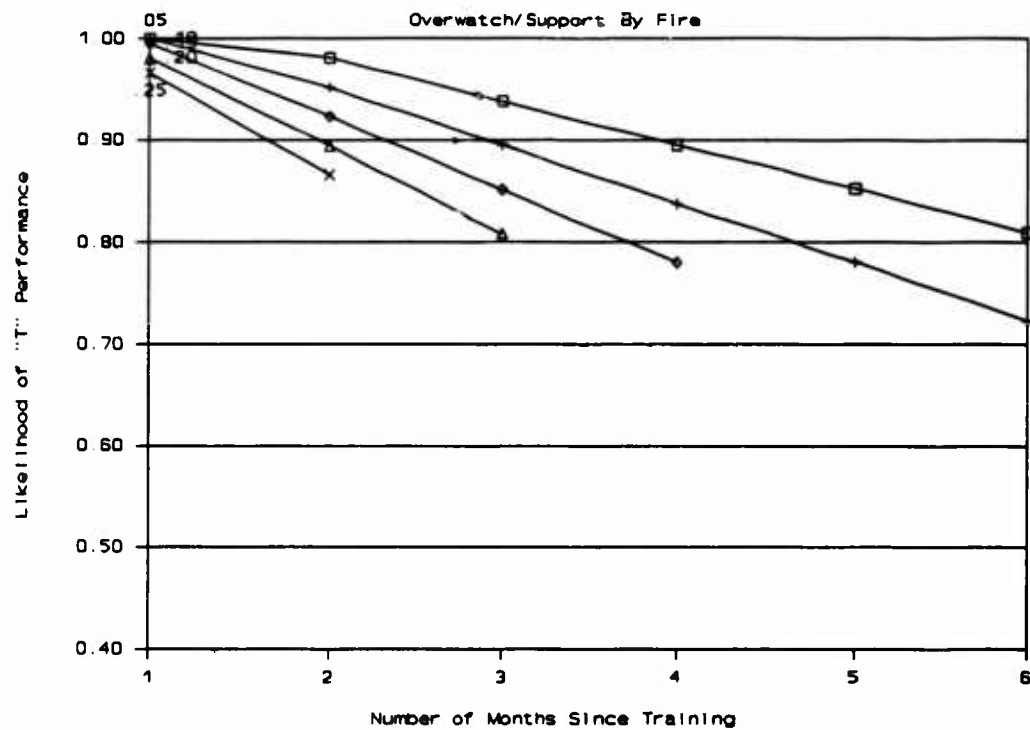
Light Infantry Squad Tasks



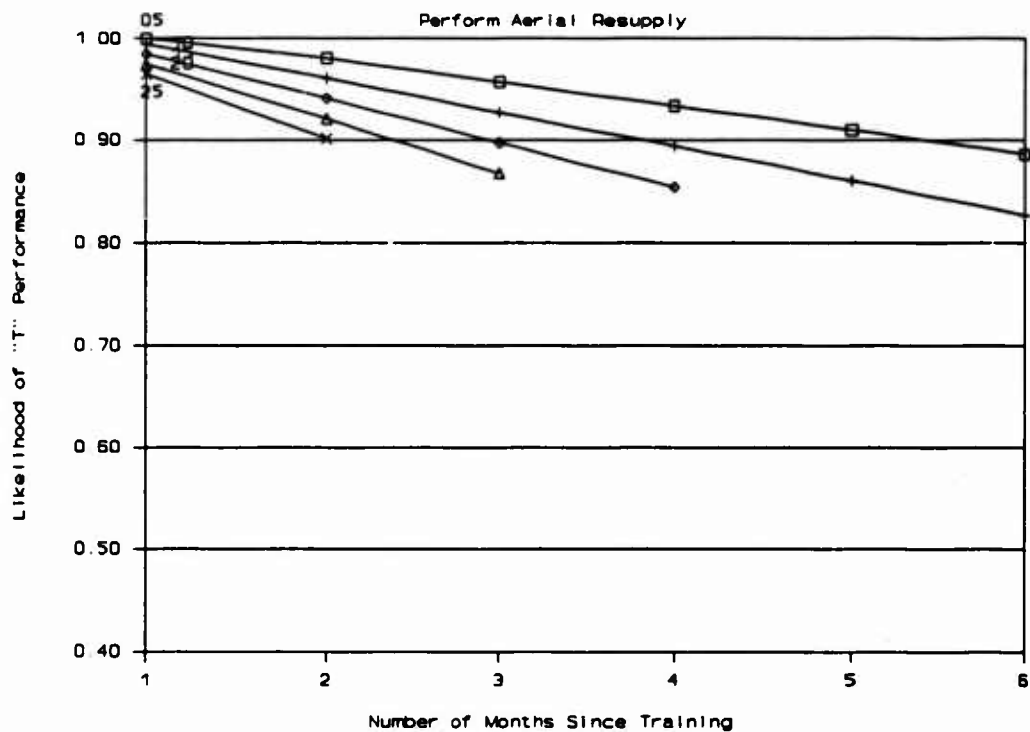
Light Infantry Squad Tasks



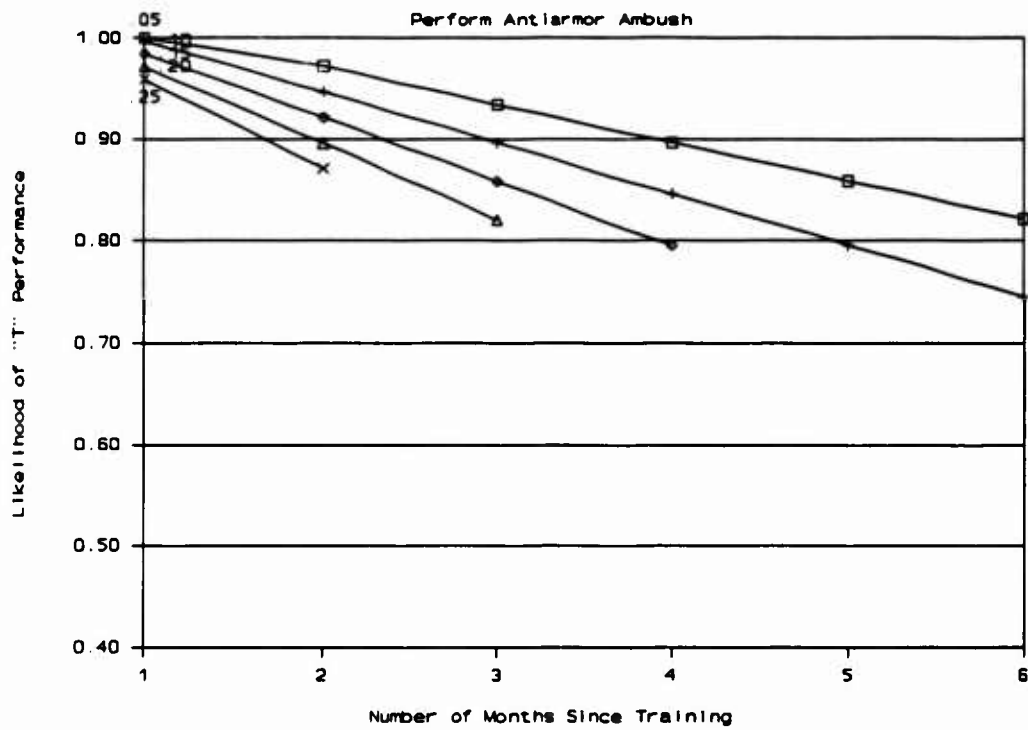
Light Infantry Squad Tasks



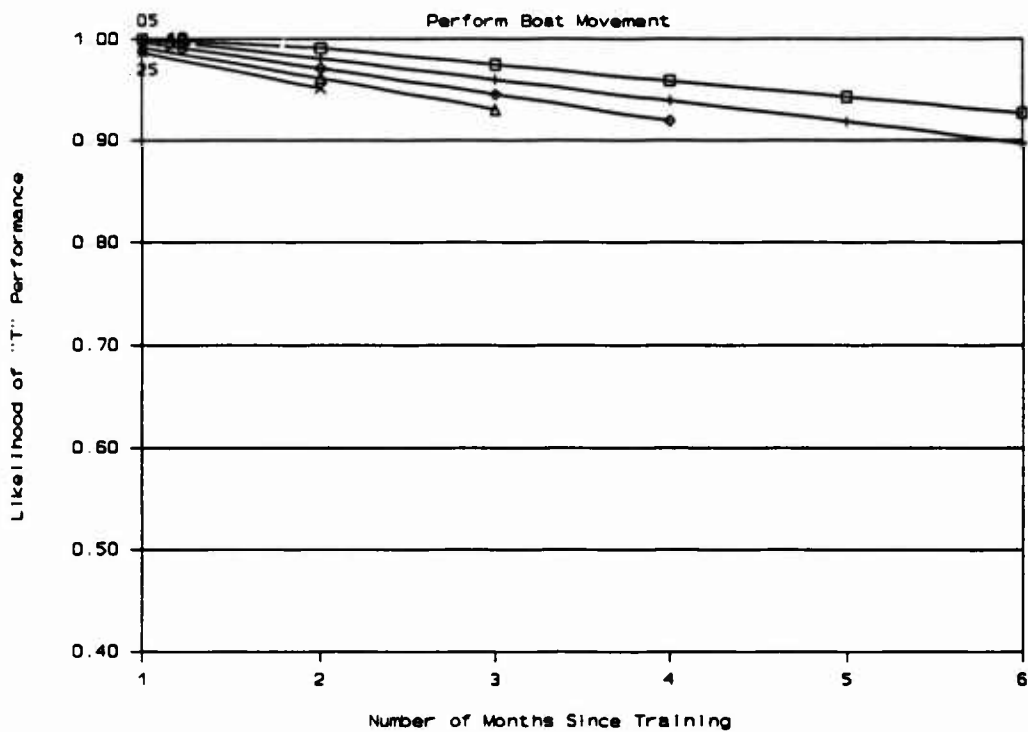
Light Infantry Squad Tasks



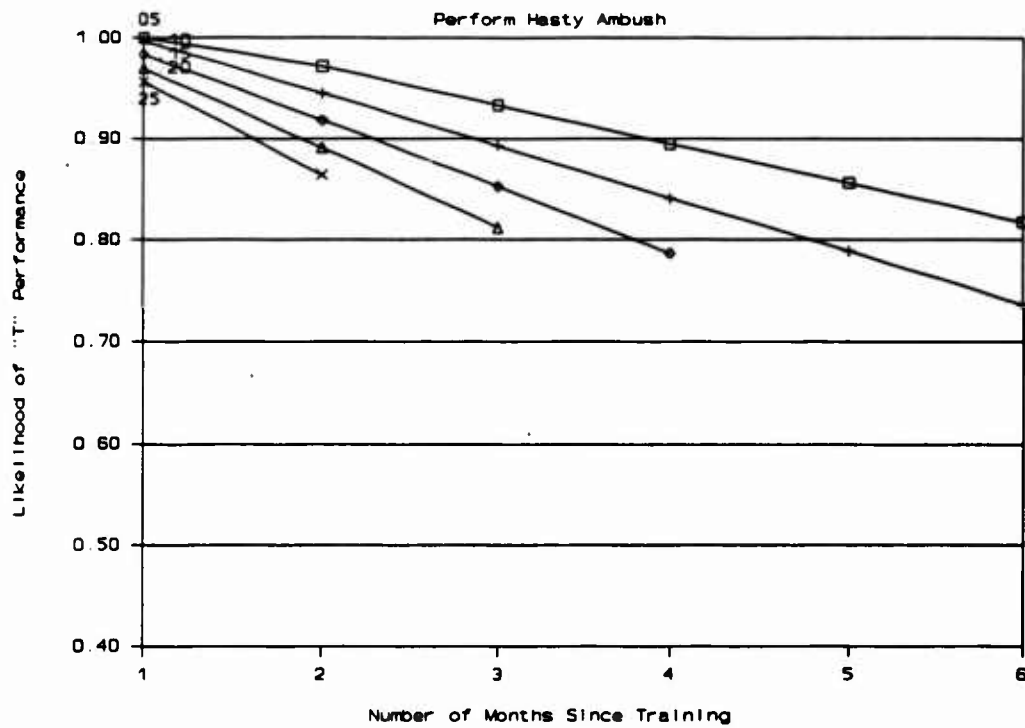
Light Infantry Squad Tasks



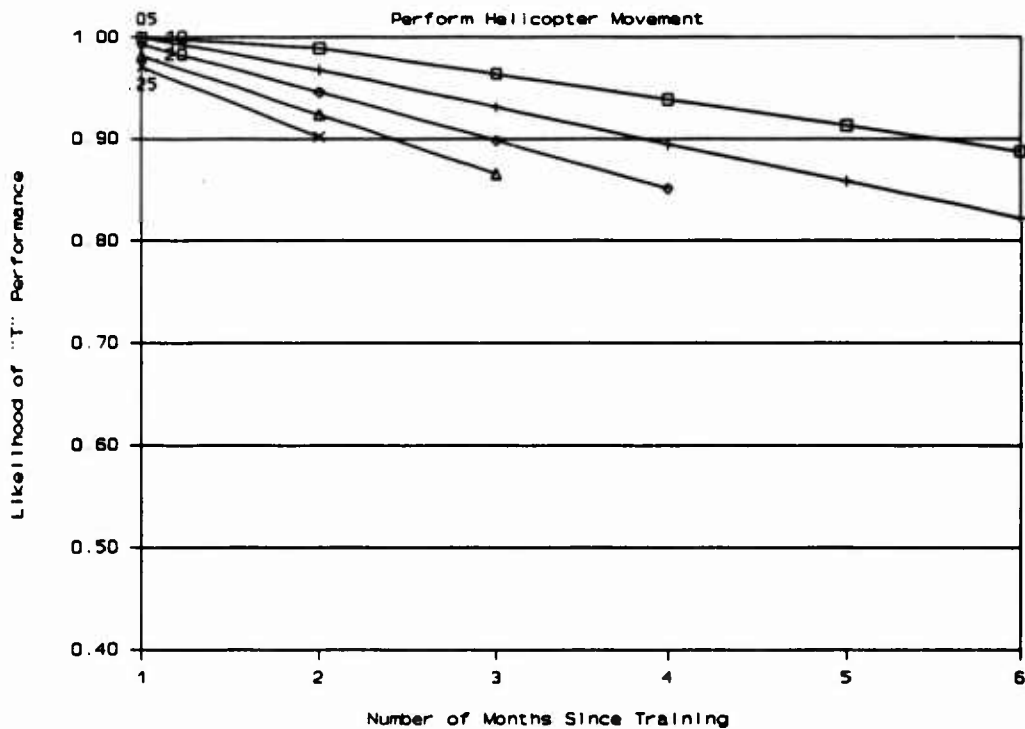
Light Infantry Squad Tasks



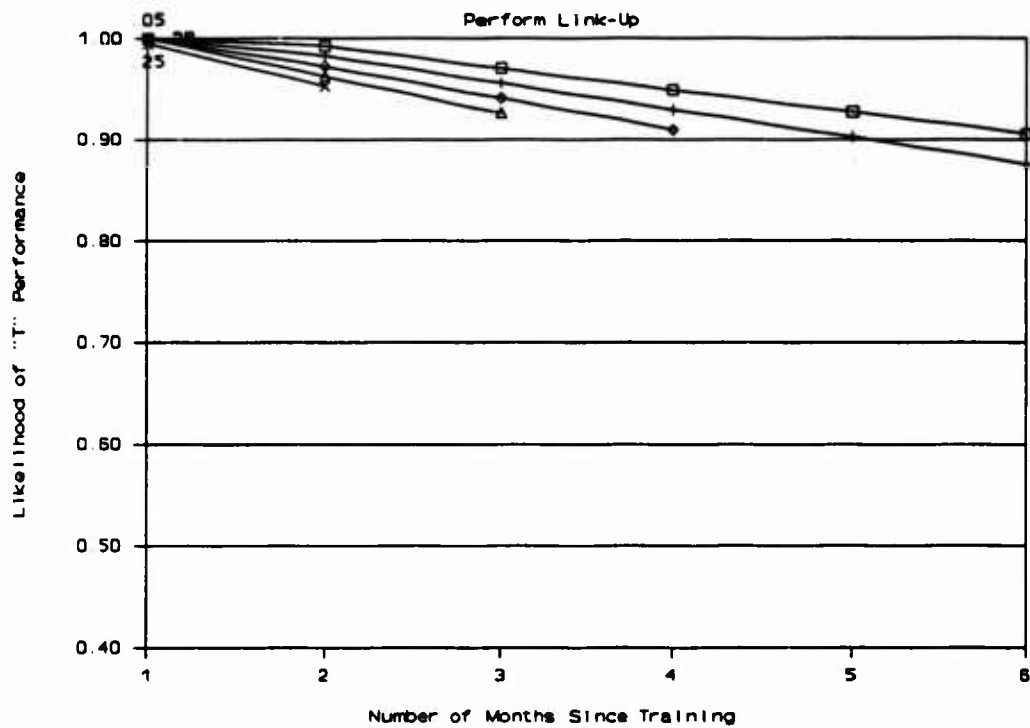
Light Infantry Squad Tasks



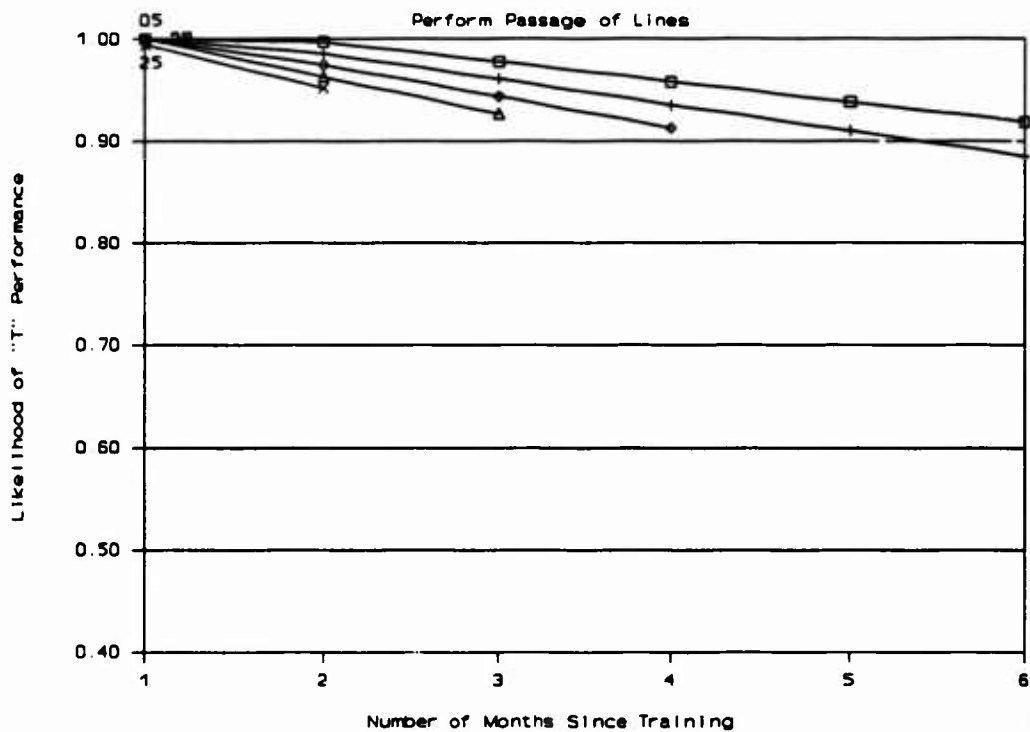
Light Infantry Squad Tasks



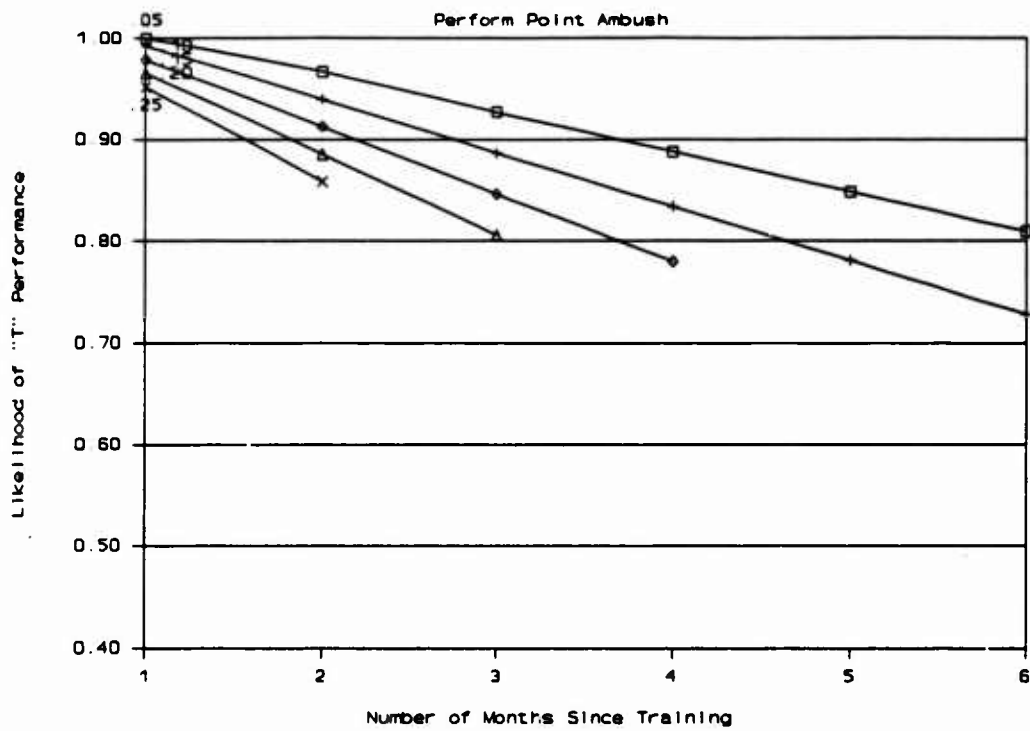
Light Infantry Squad Tasks



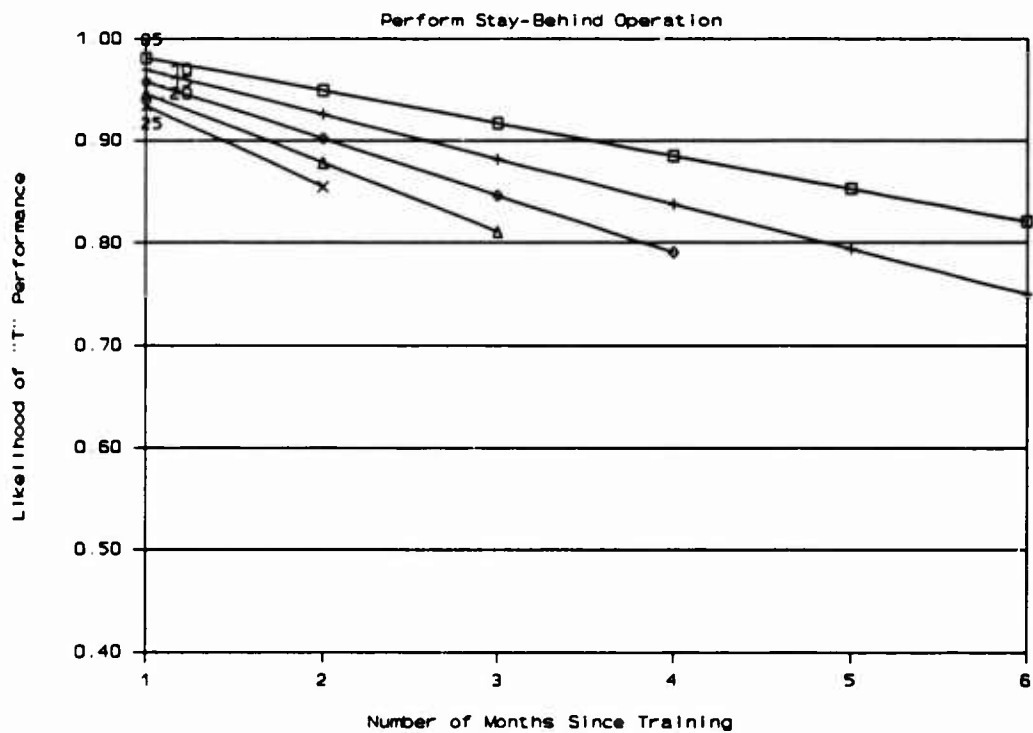
Light Infantry Squad Tasks



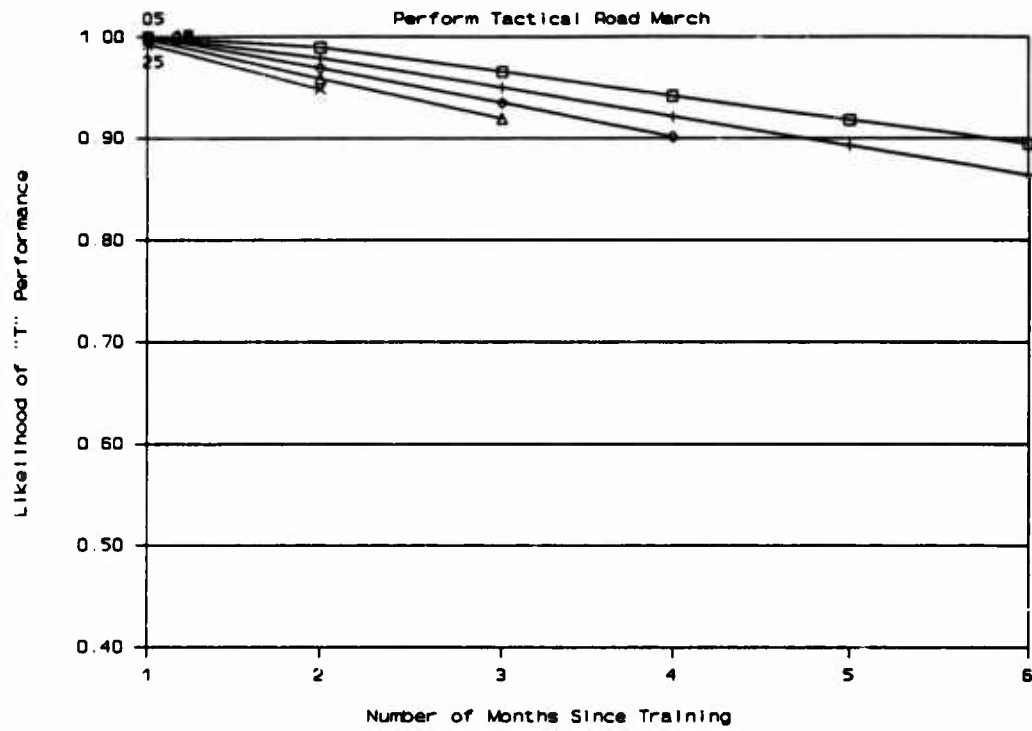
Light Infantry Squad Tasks



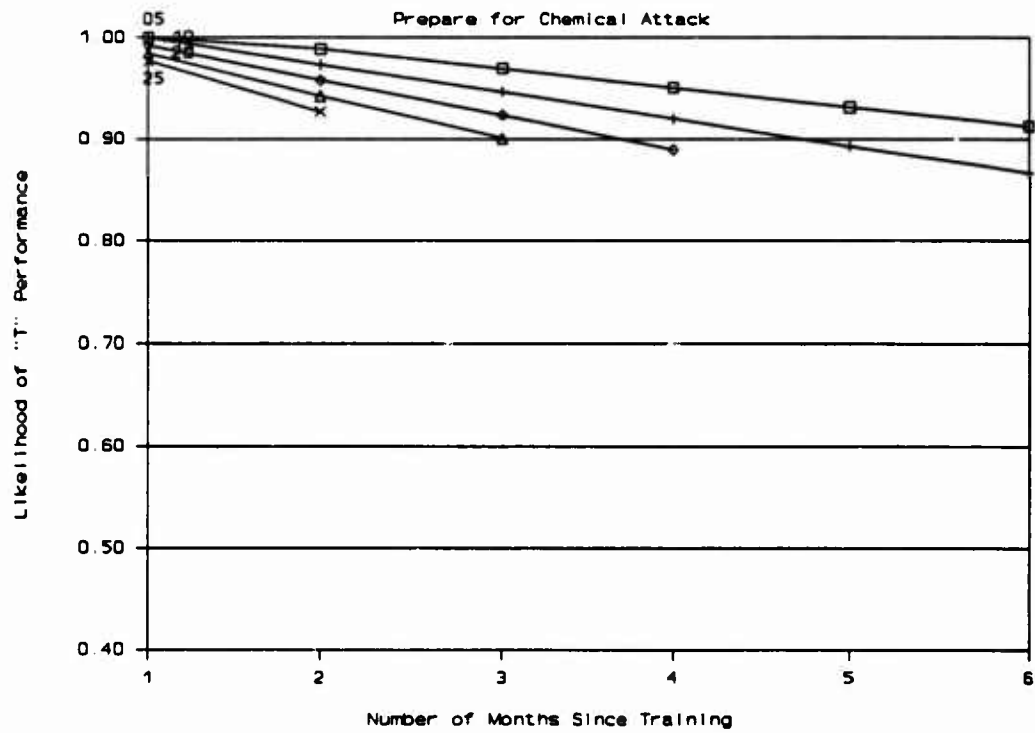
Light Infantry Squad Tasks



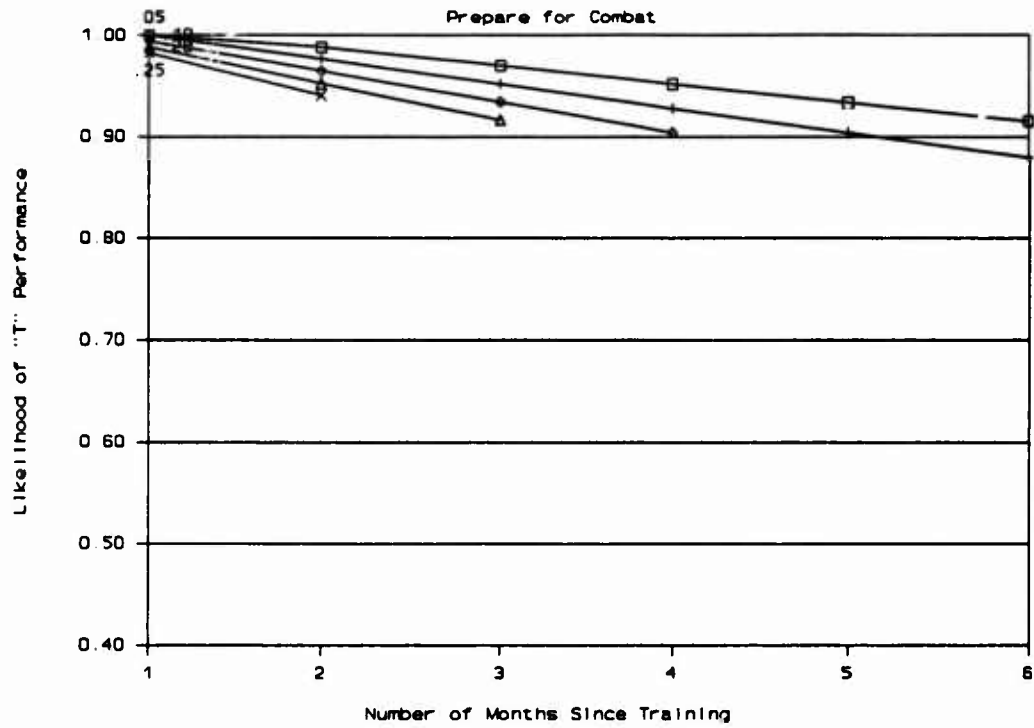
Light Infantry Squad Tasks



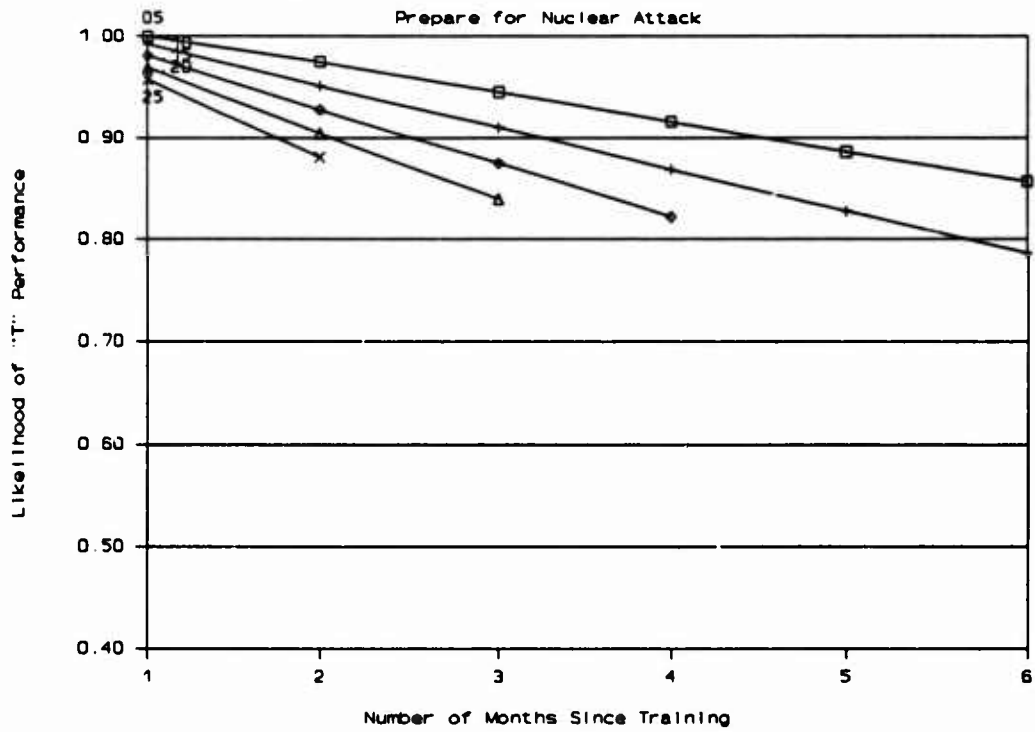
Light Infantry Squad Tasks



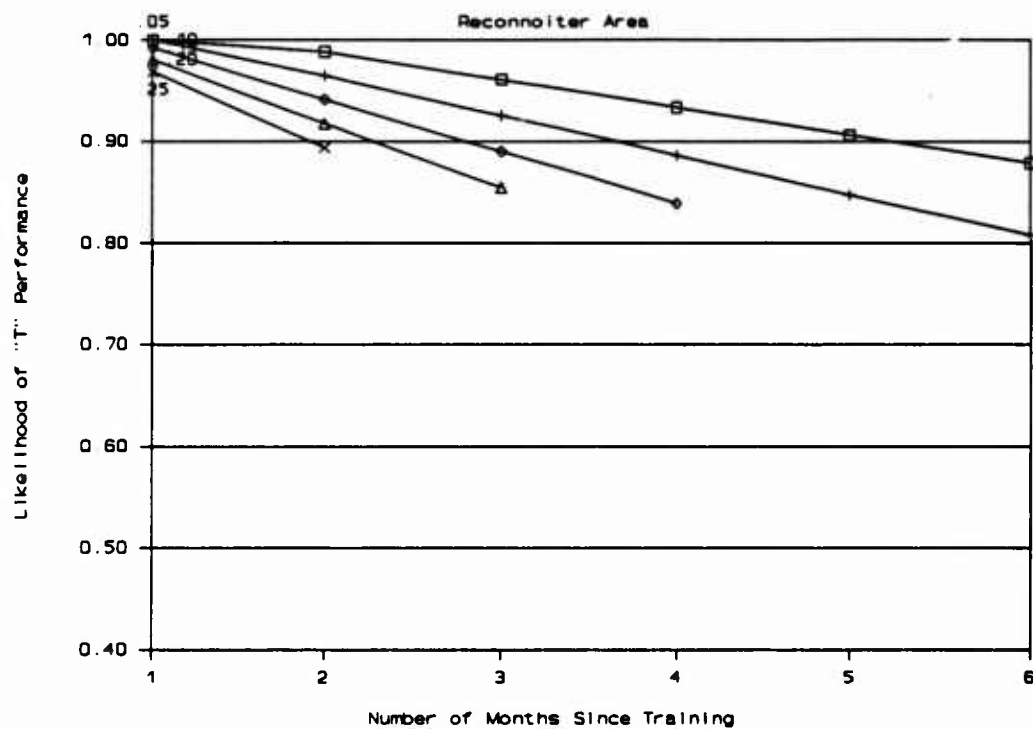
Light Infantry Squad Tasks



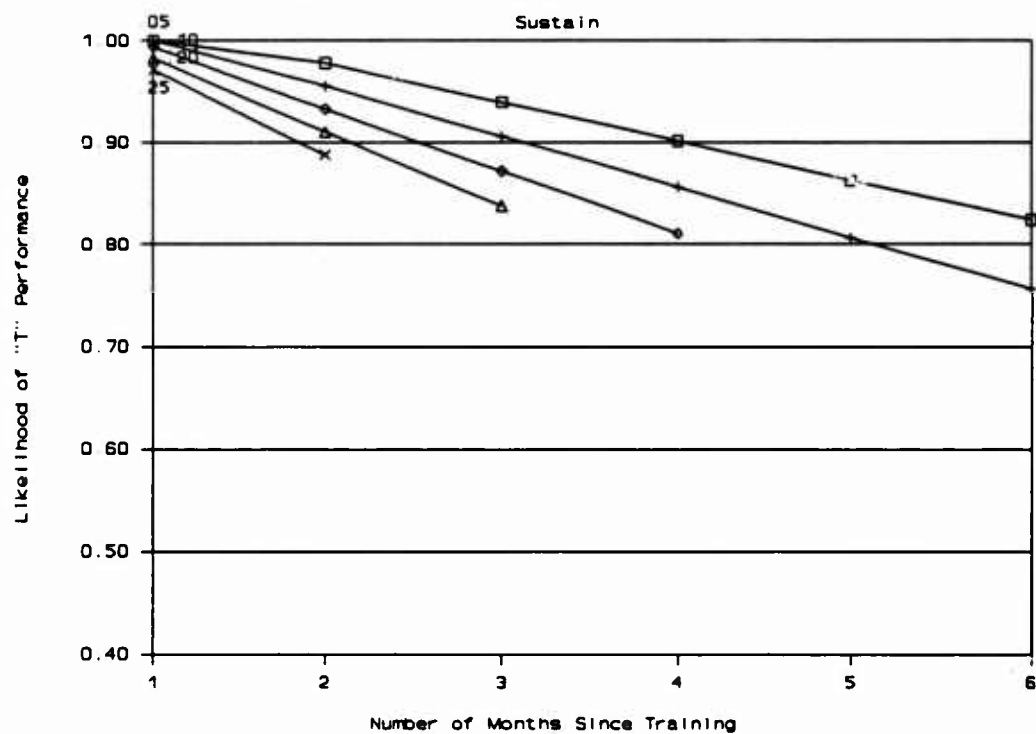
Light Infantry Squad Tasks



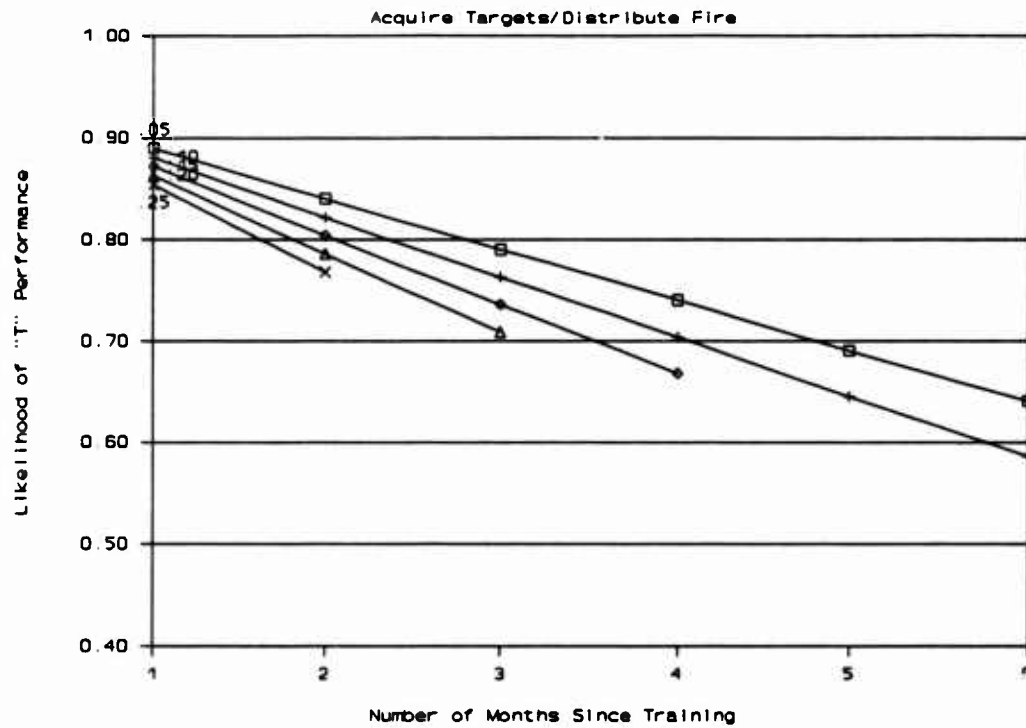
Light Infantry Squad Tasks



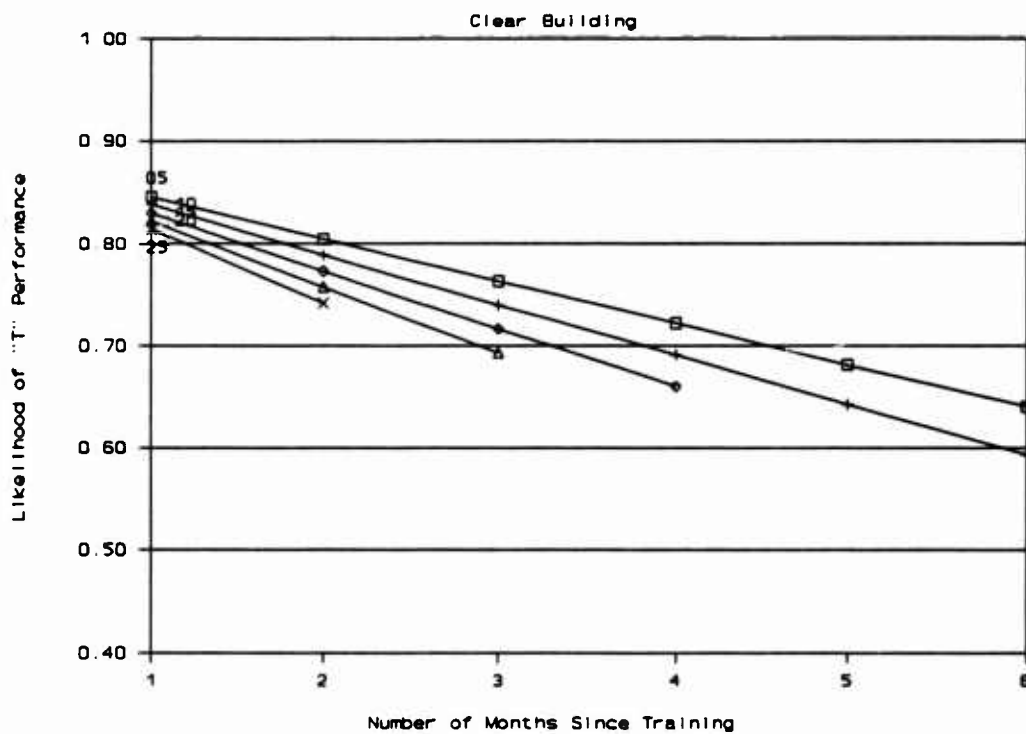
Light Infantry Squad Tasks



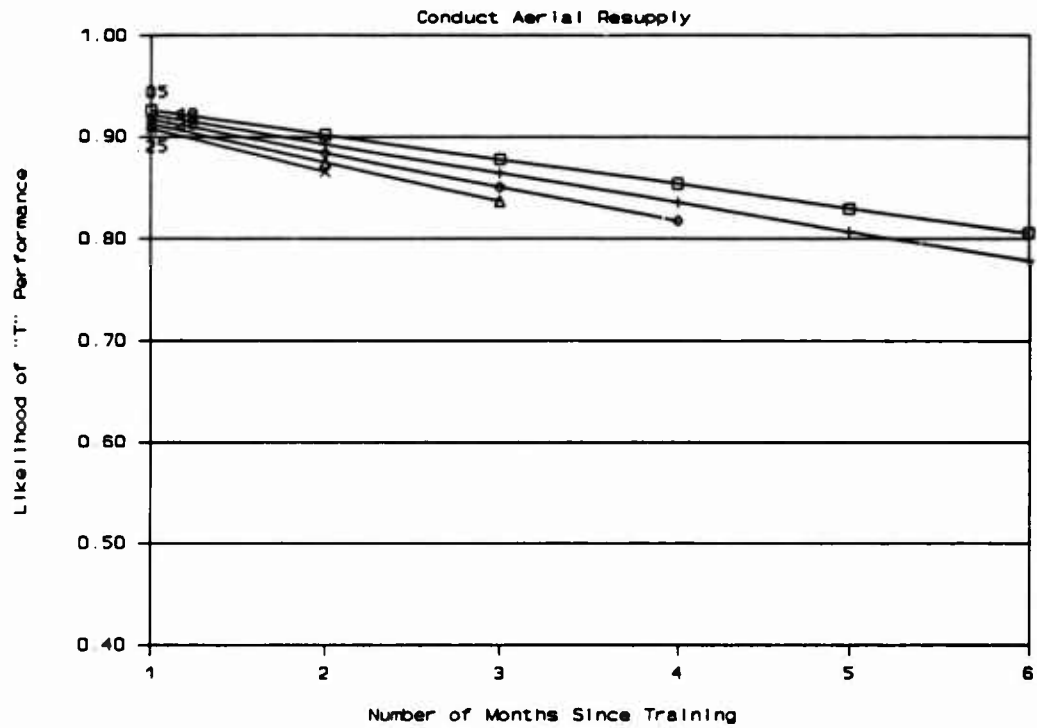
Mechanized Infantry Squad Tasks



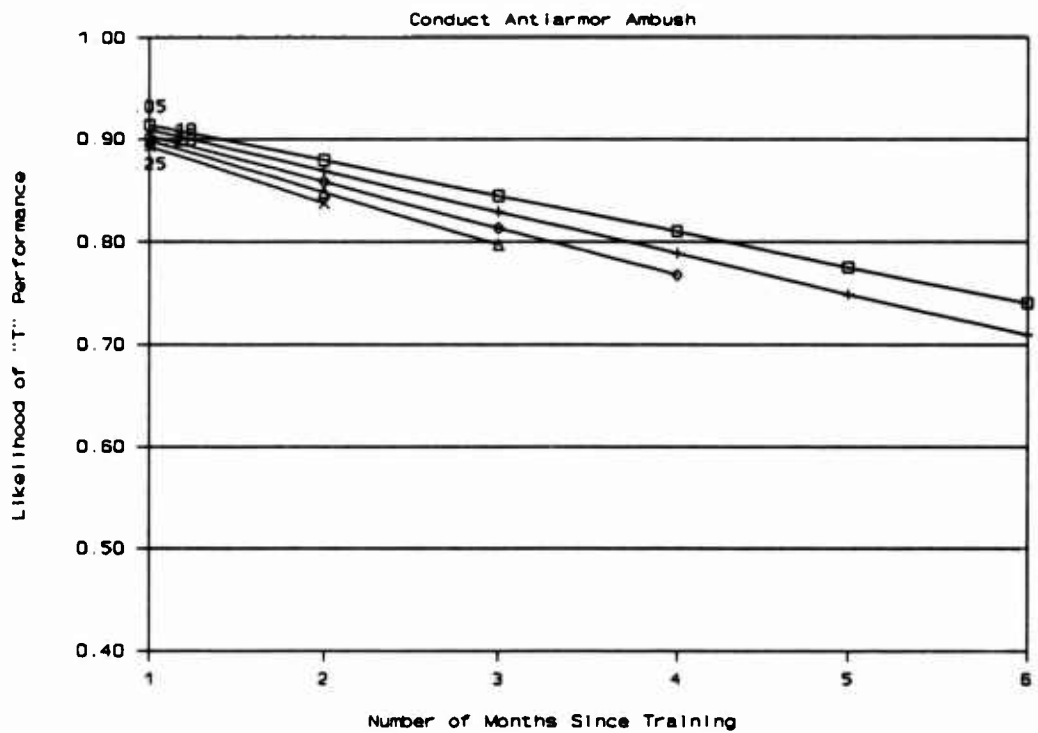
Mechanized Infantry Squad Tasks



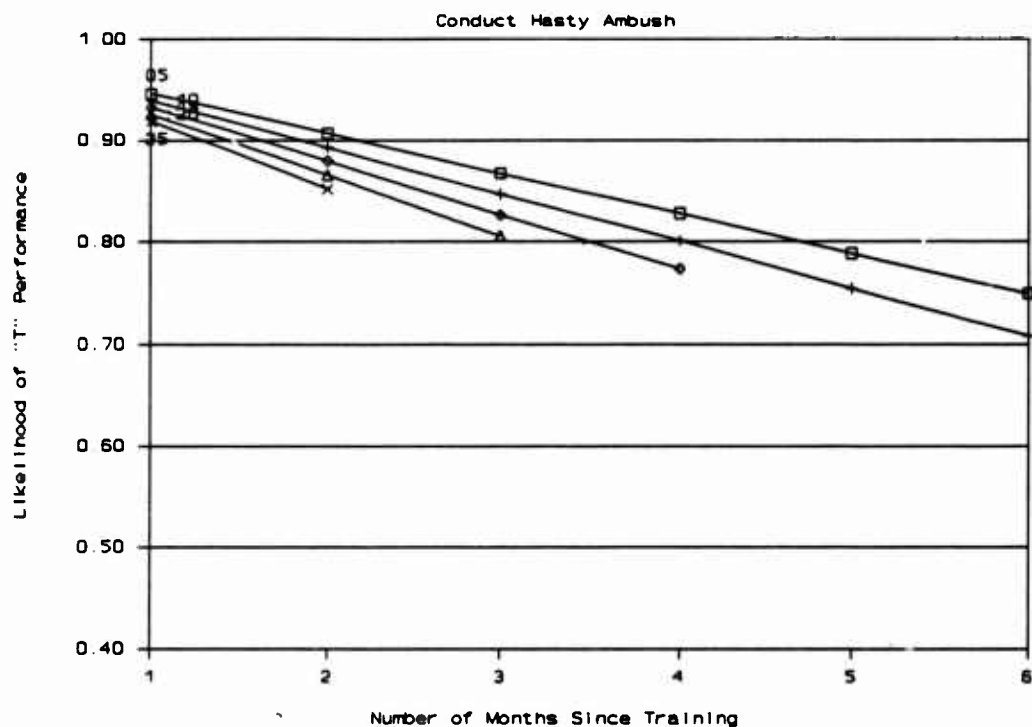
Mechanized Infantry Squad Tasks



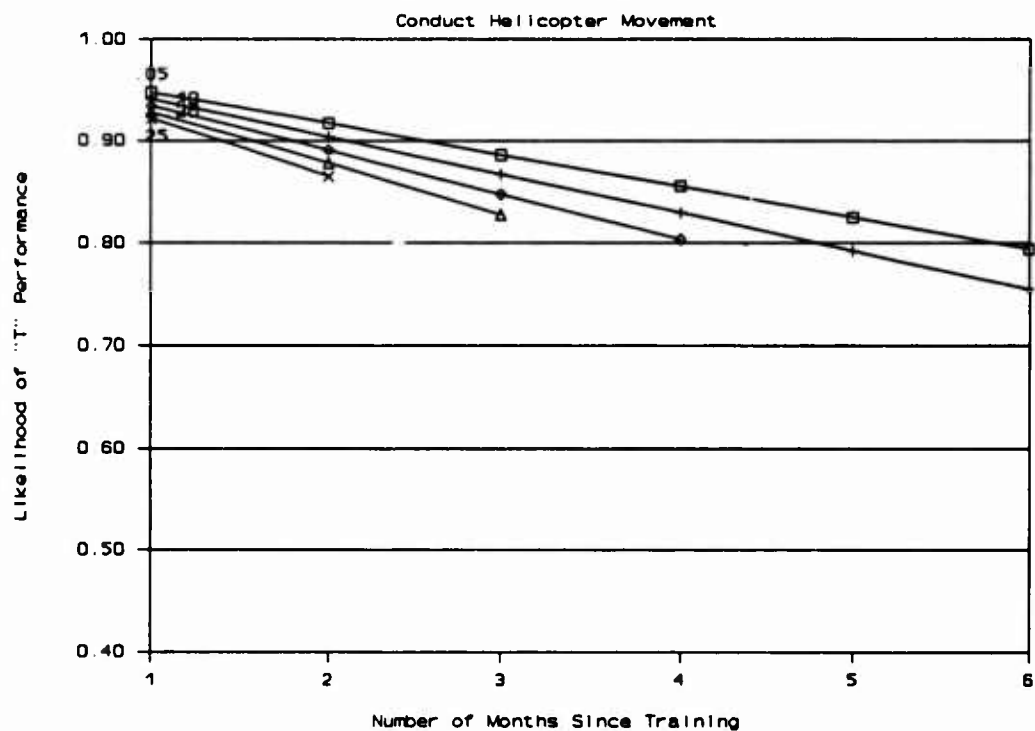
Mechanized Infantry Squad Tasks



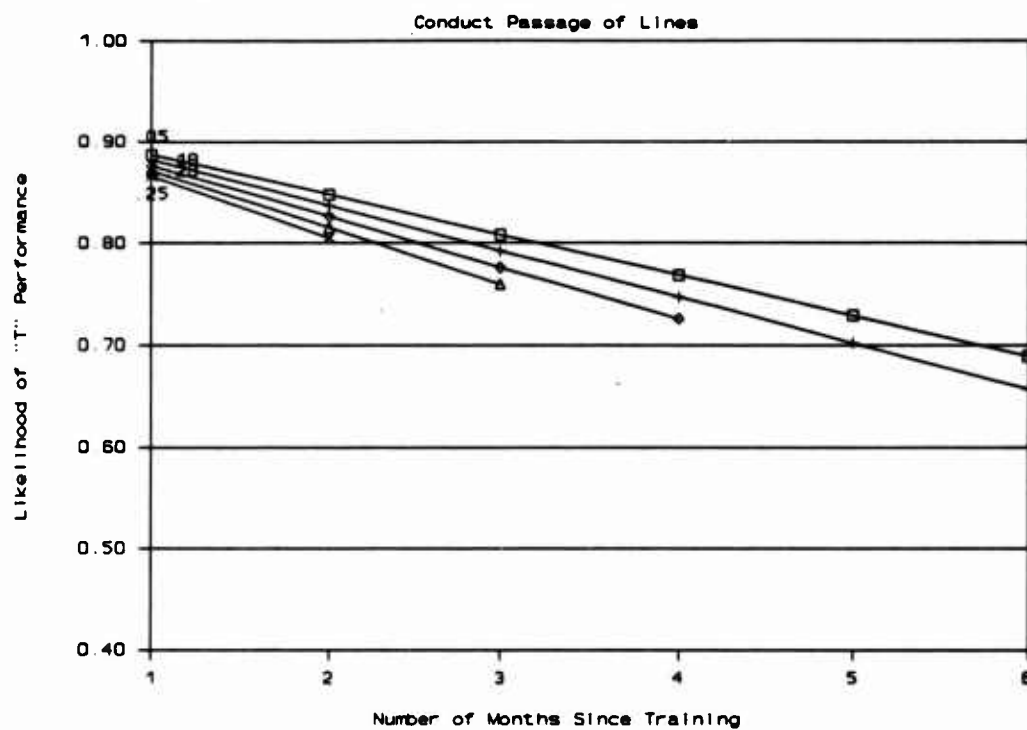
Mechanized Infantry Squad Tasks



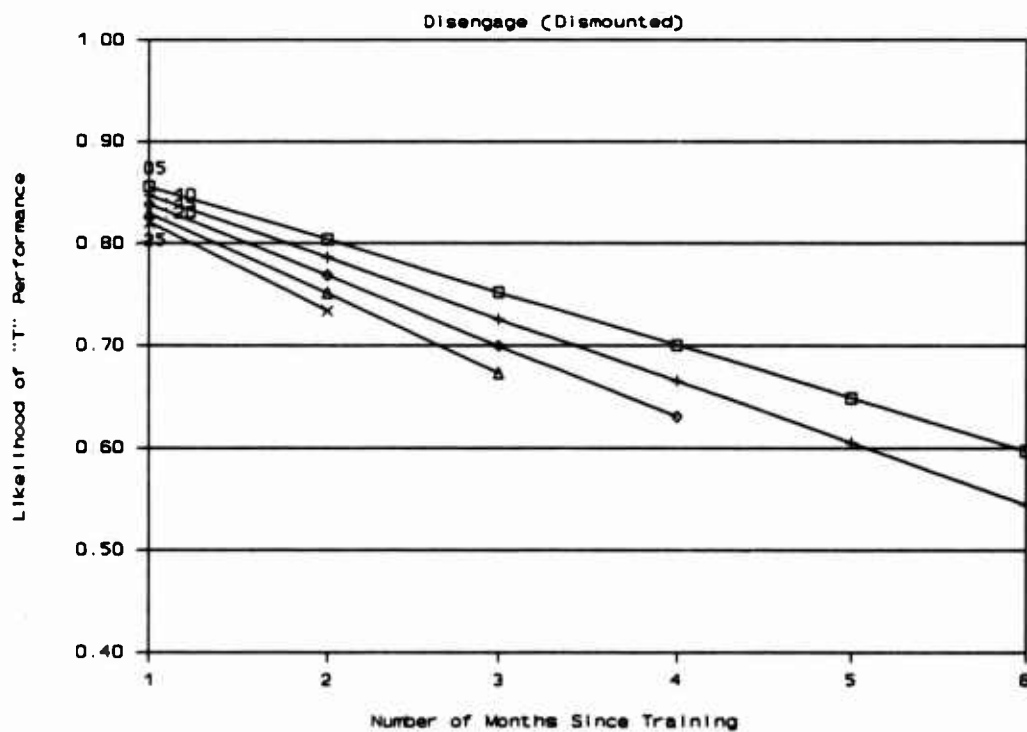
Mechanized Infantry Squad Tasks



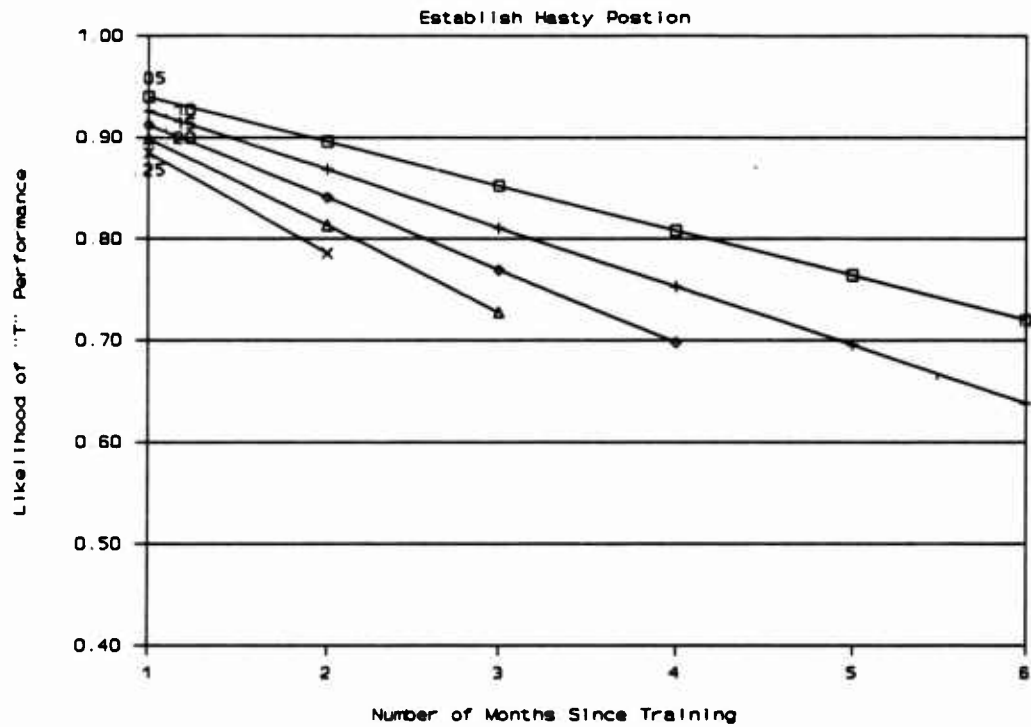
Mechanized Infantry Squad Tasks



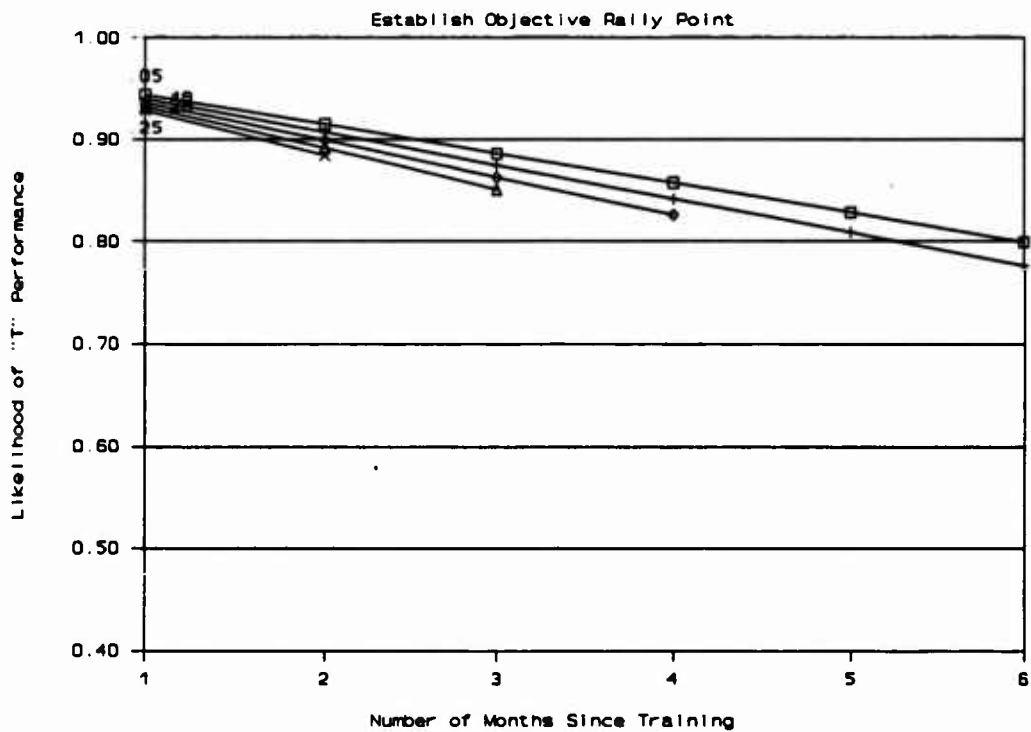
Mechanized Infantry Squad Tasks



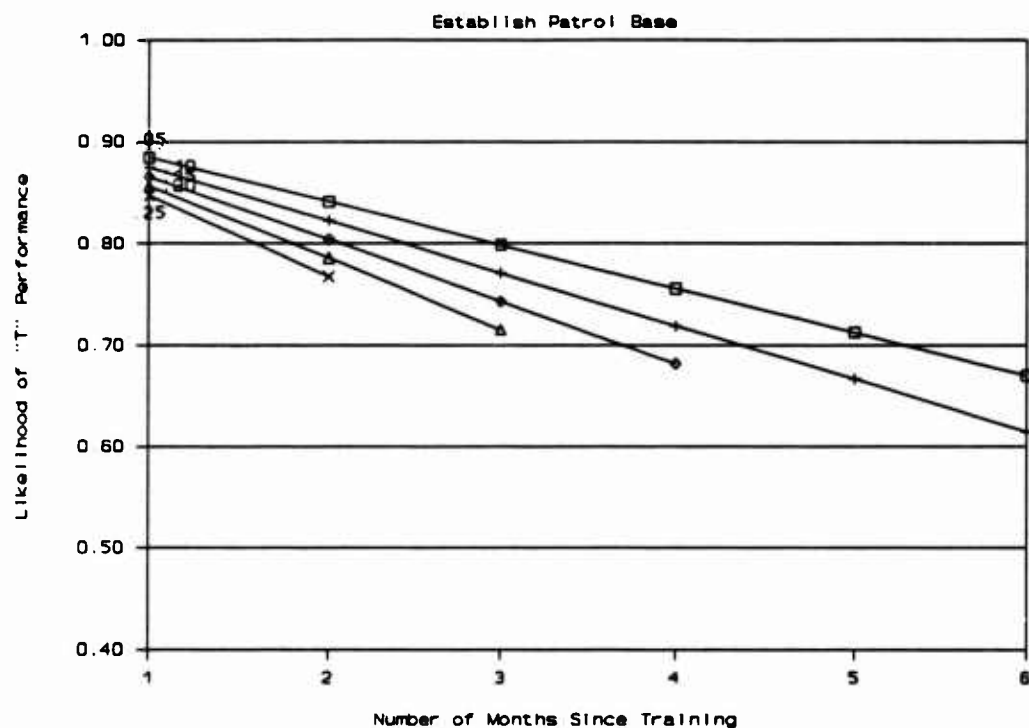
Mechanized Infantry Squad Tasks



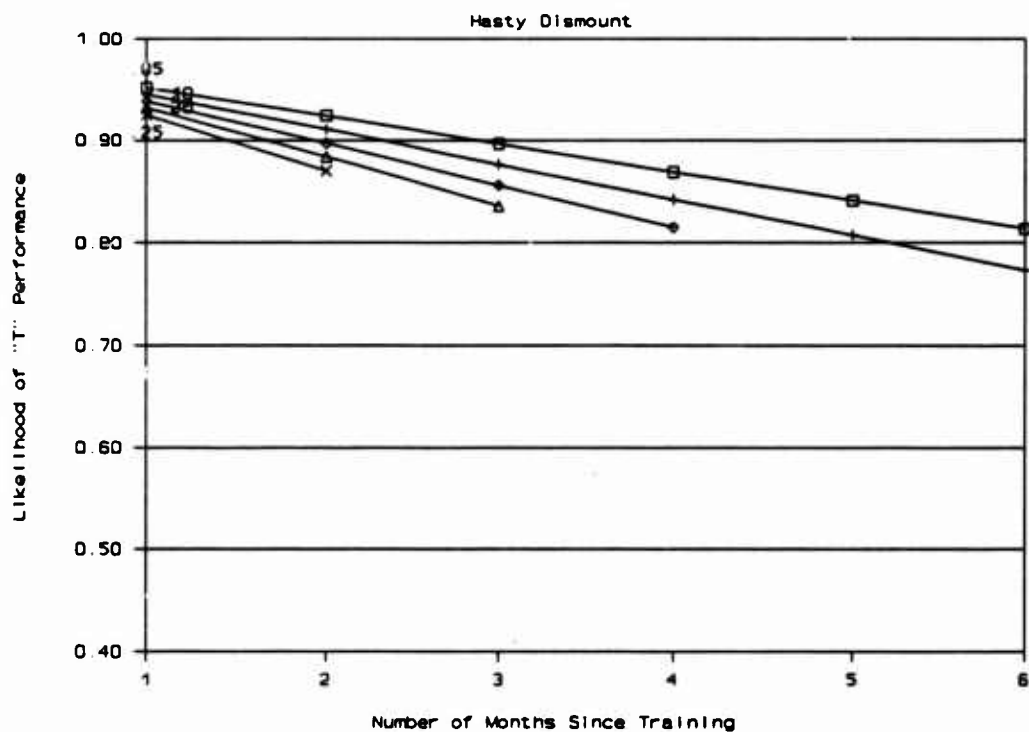
Mechanized Infantry Squad Tasks



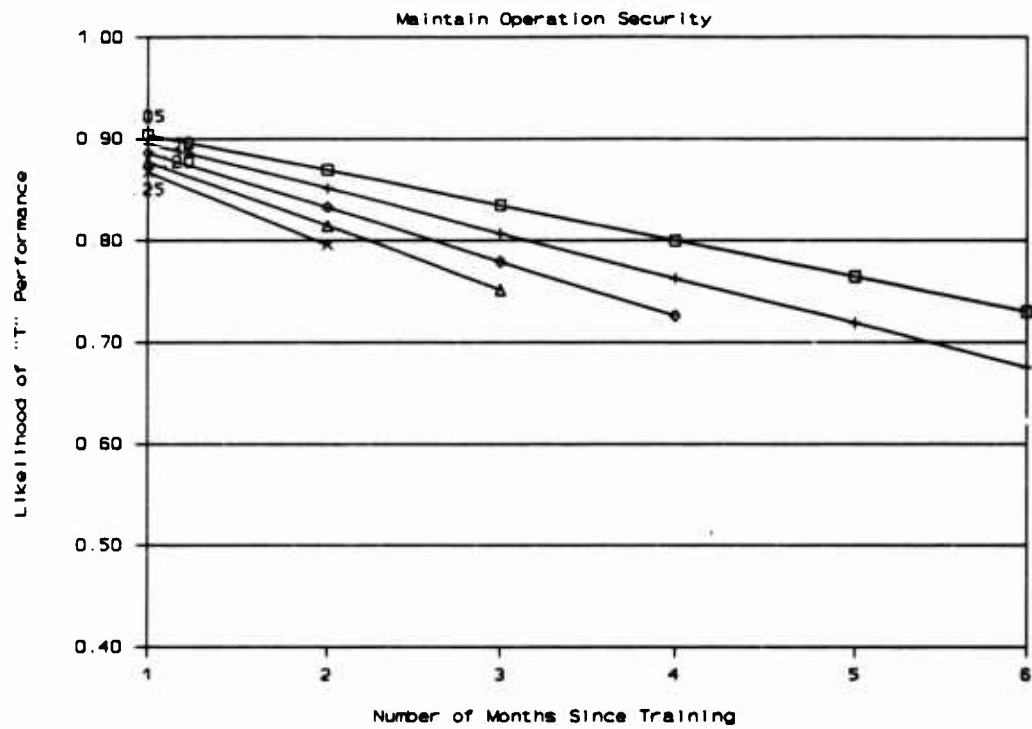
Mechanized Infantry Squad Tasks



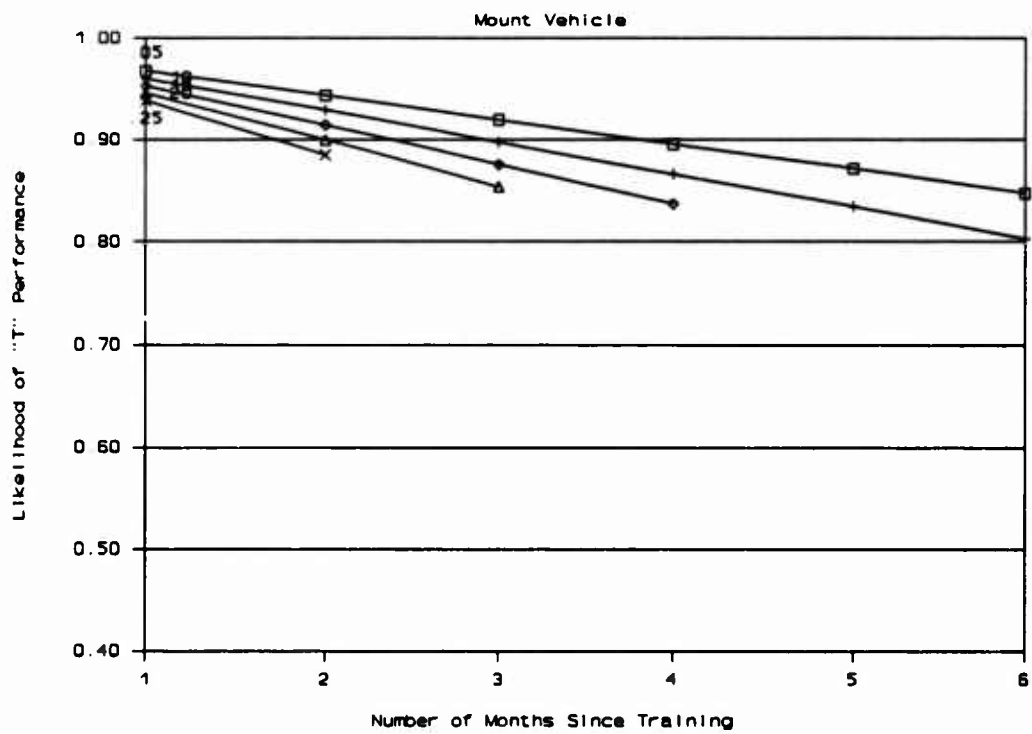
Mechanized Infantry Squad Tasks



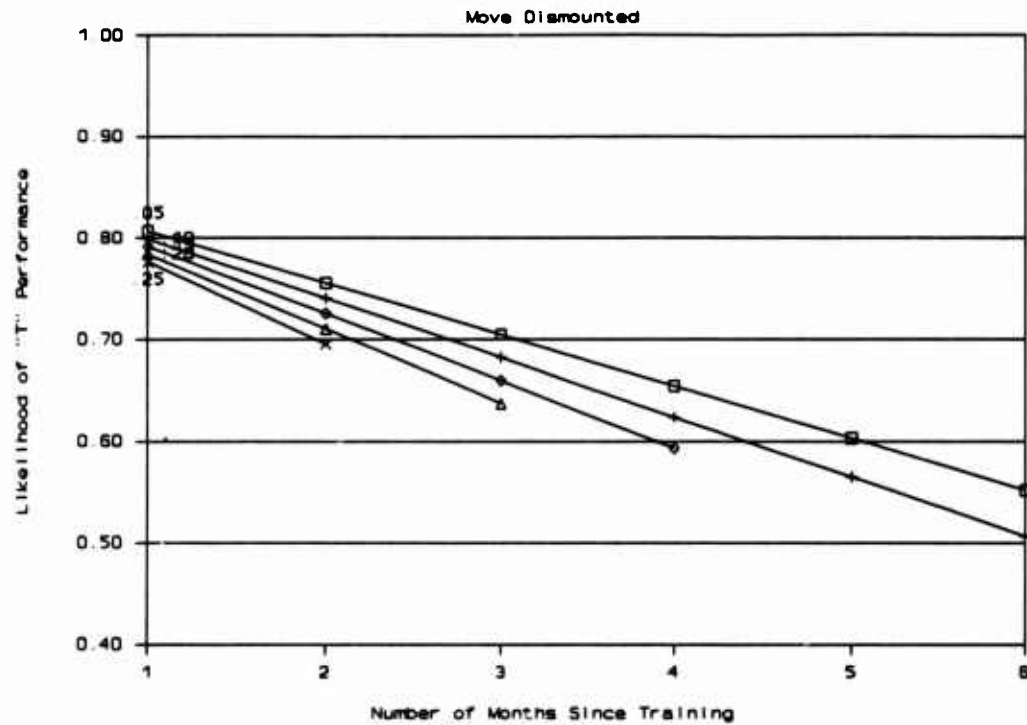
Mechanized Infantry Squad Tasks



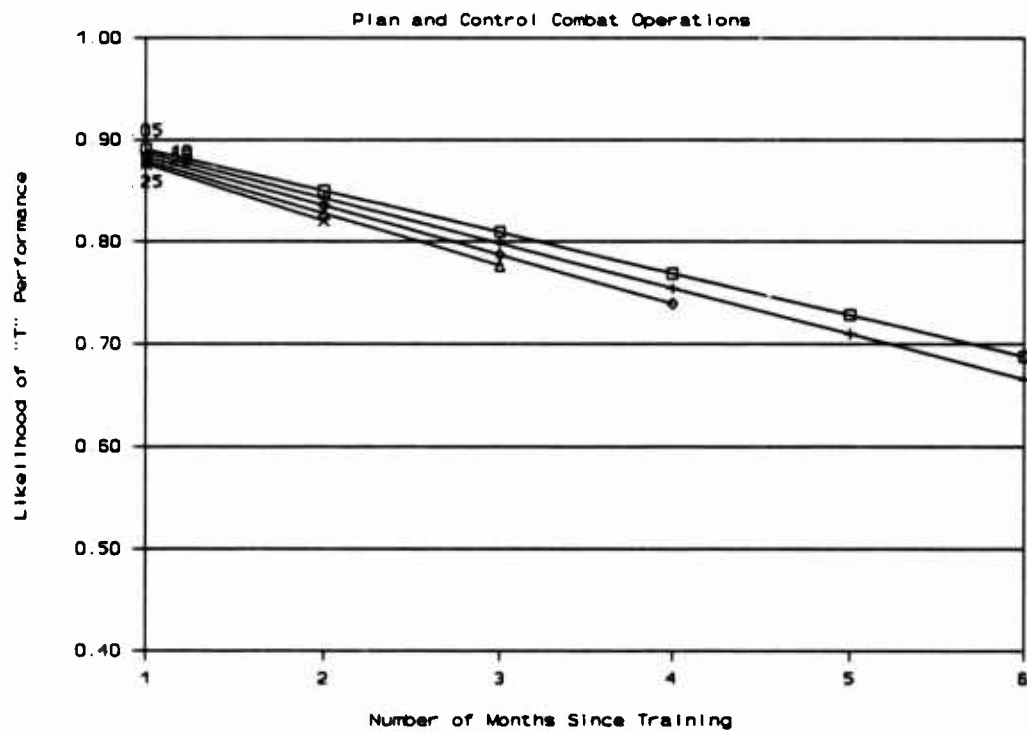
Mechanized Infantry Squad Tasks



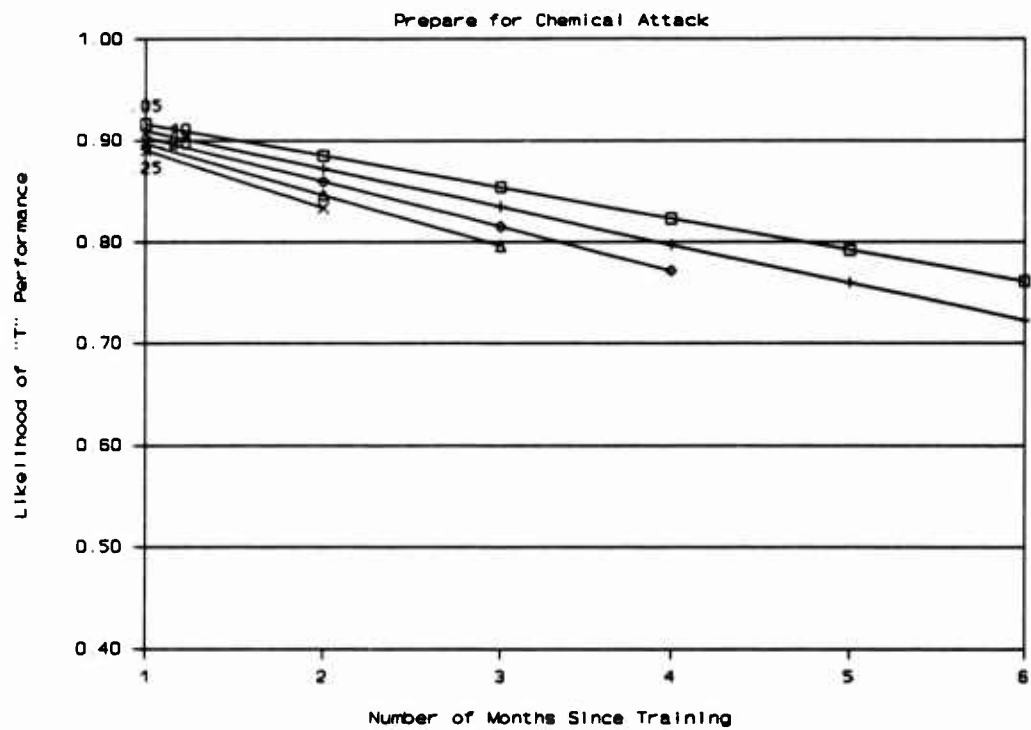
Mechanized Infantry Squad Tasks



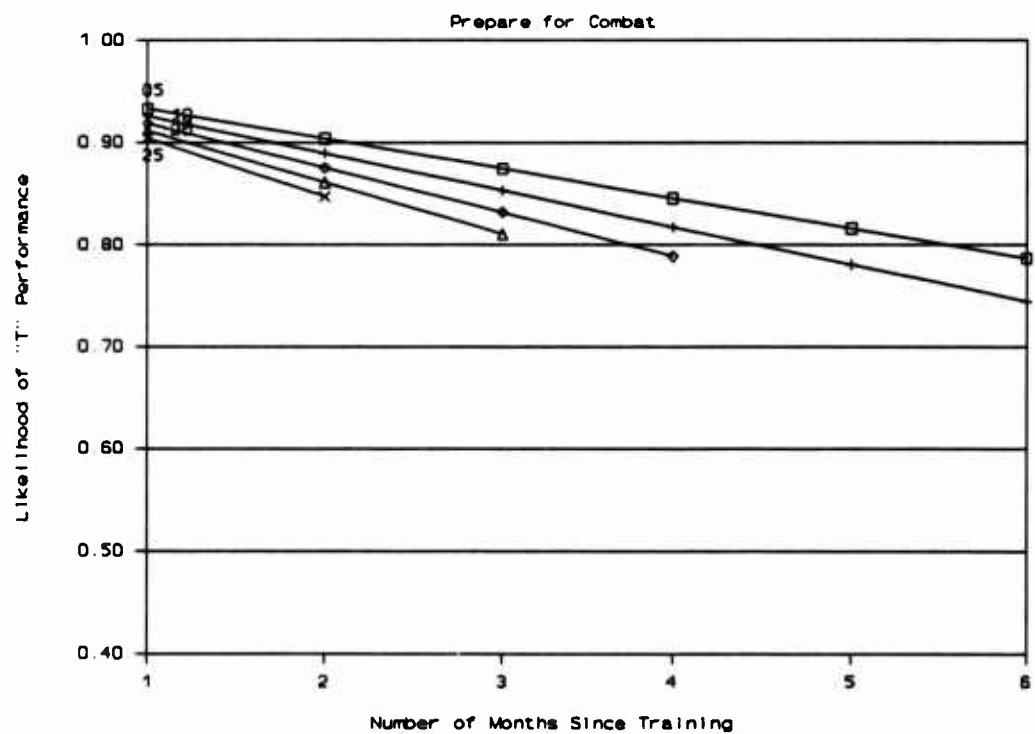
Mechanized Infantry Squad Tasks



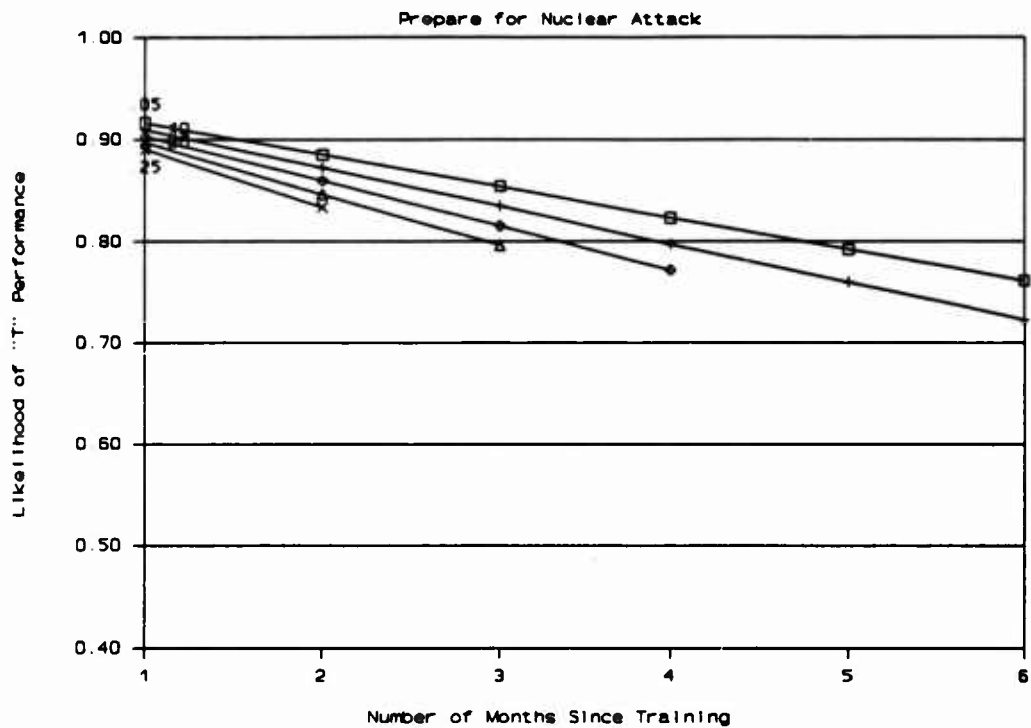
Mechanized Infantry Squad Tasks



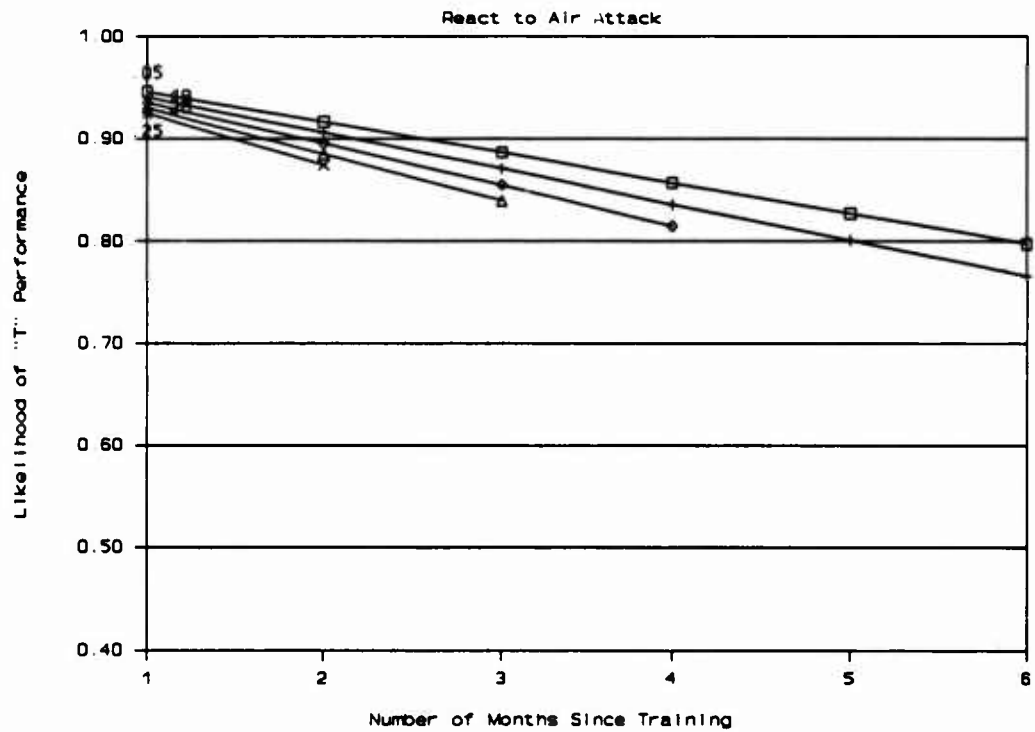
Mechanized Infantry Squad Tasks



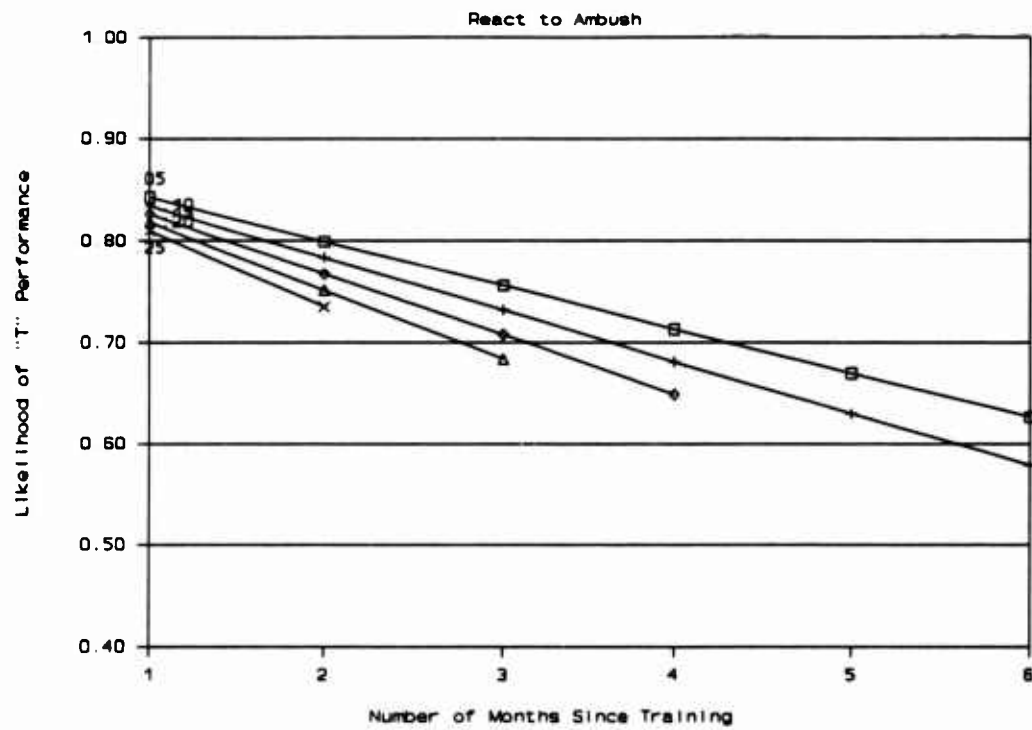
Mechanized Infantry Squad Tasks



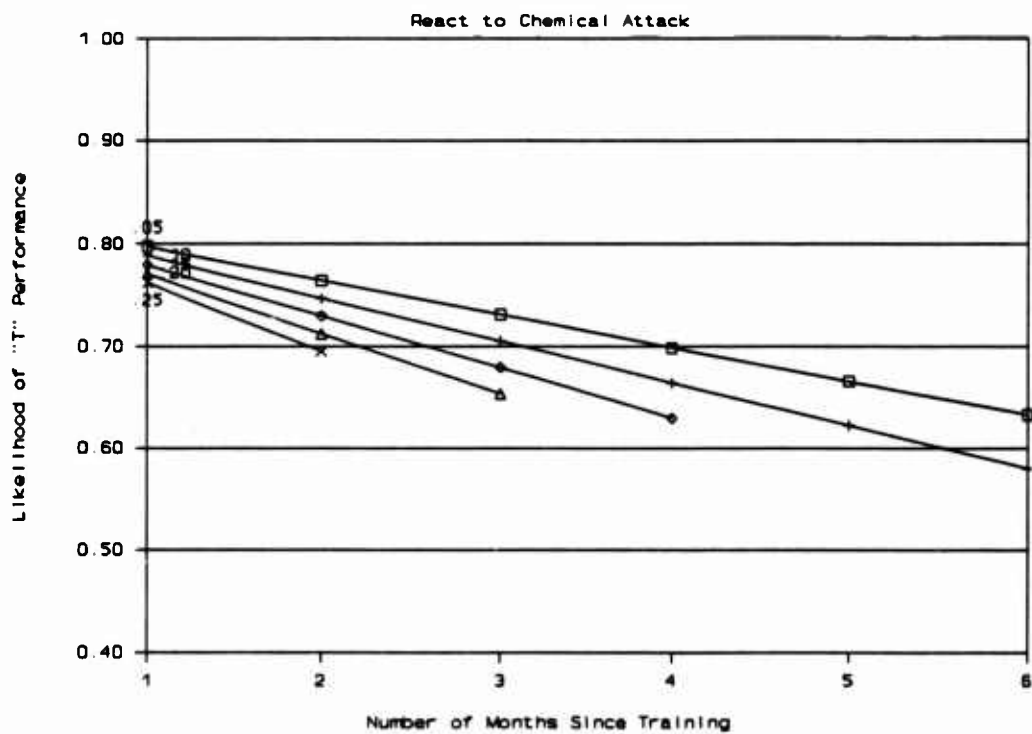
Mechanized Infantry Squad Tasks



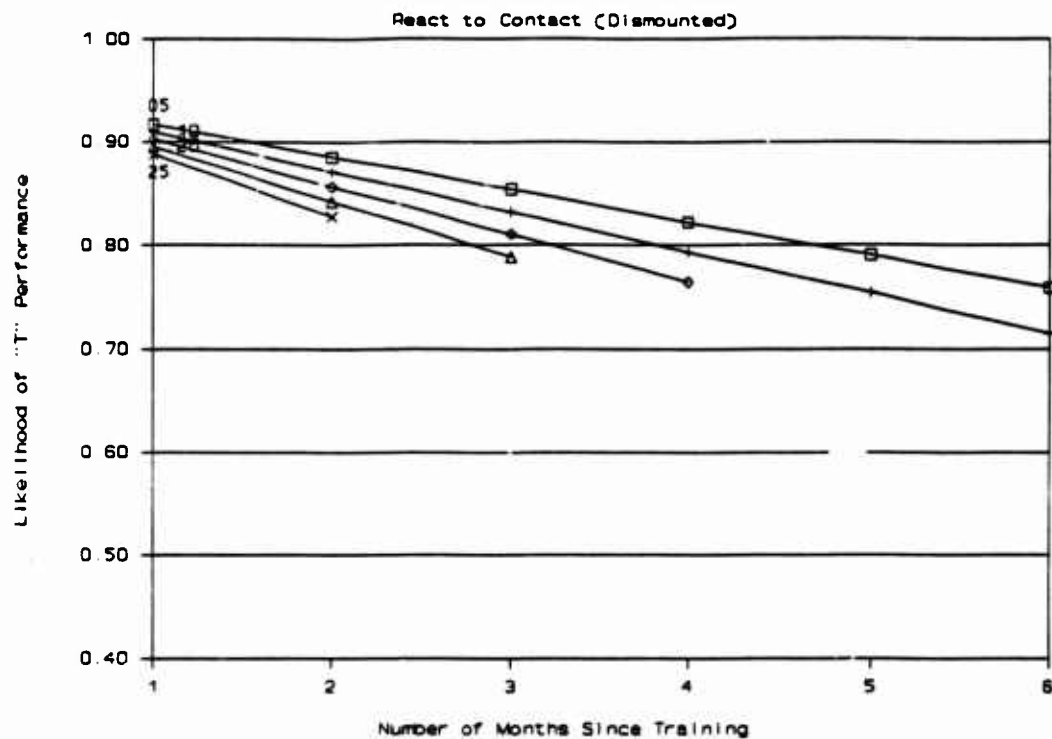
Mechanized Infantry Squad Tasks



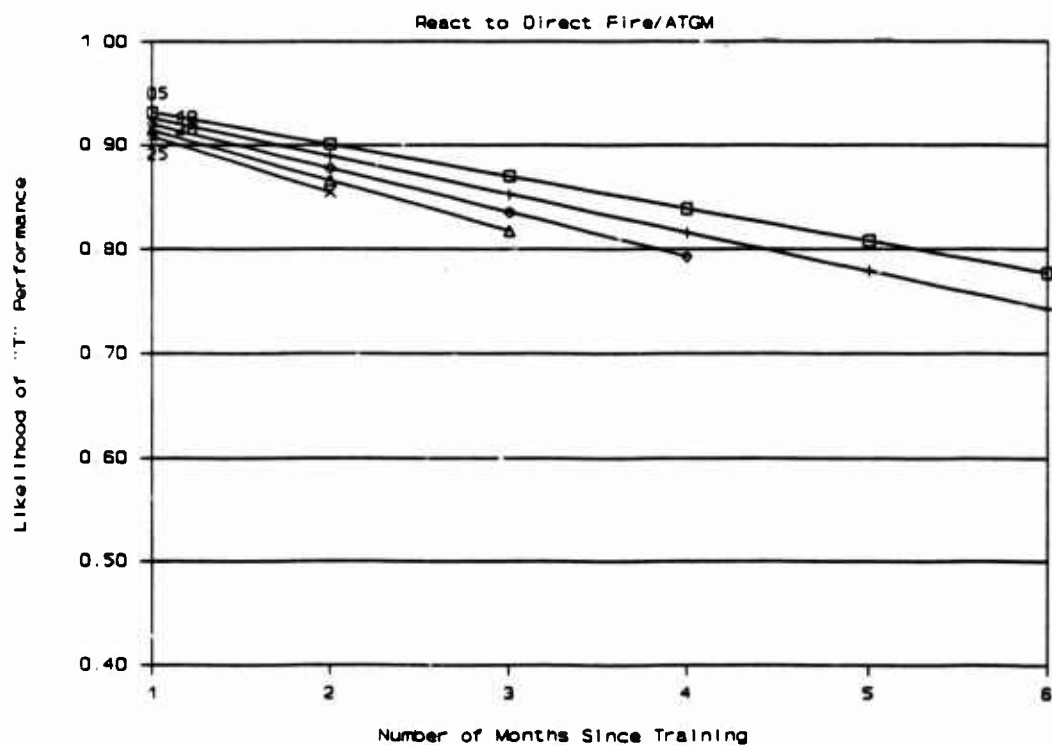
Mechanized Infantry Squad Tasks



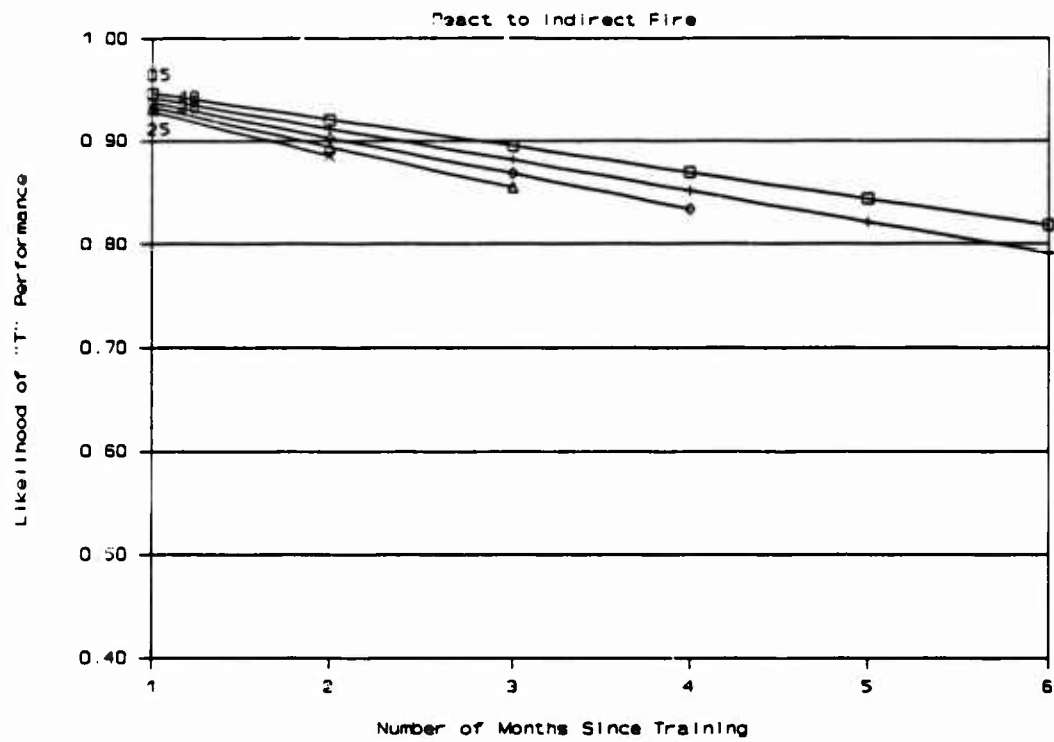
Mechanized Infantry Squad Tasks



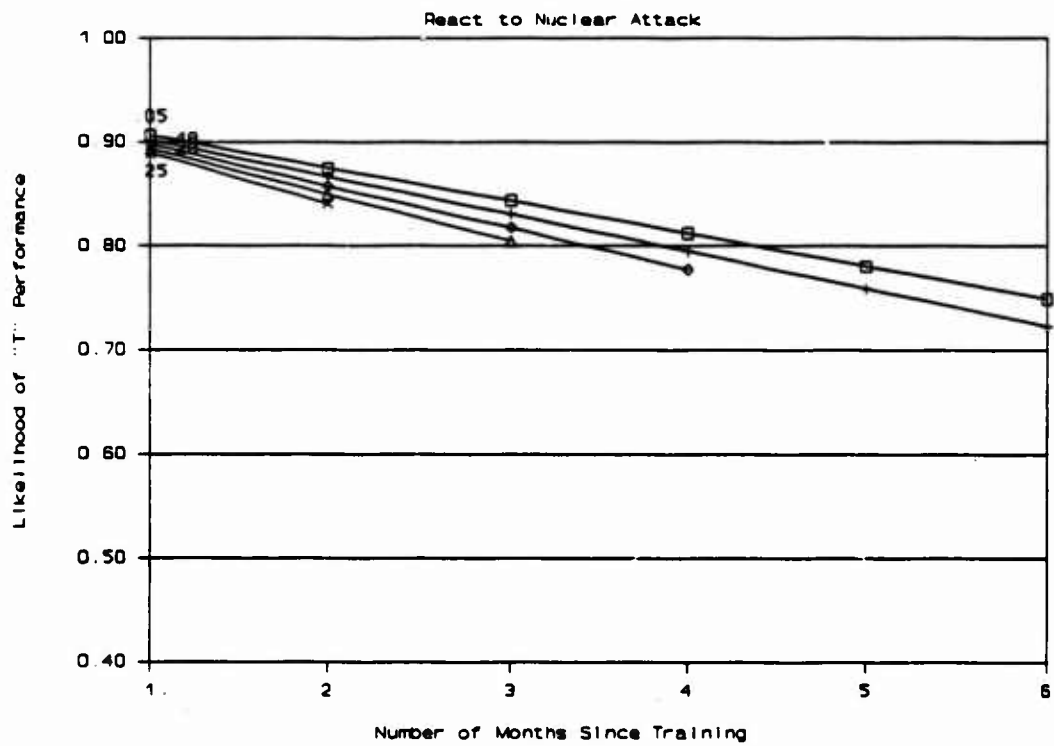
Mechanized Infantry Squad Tasks



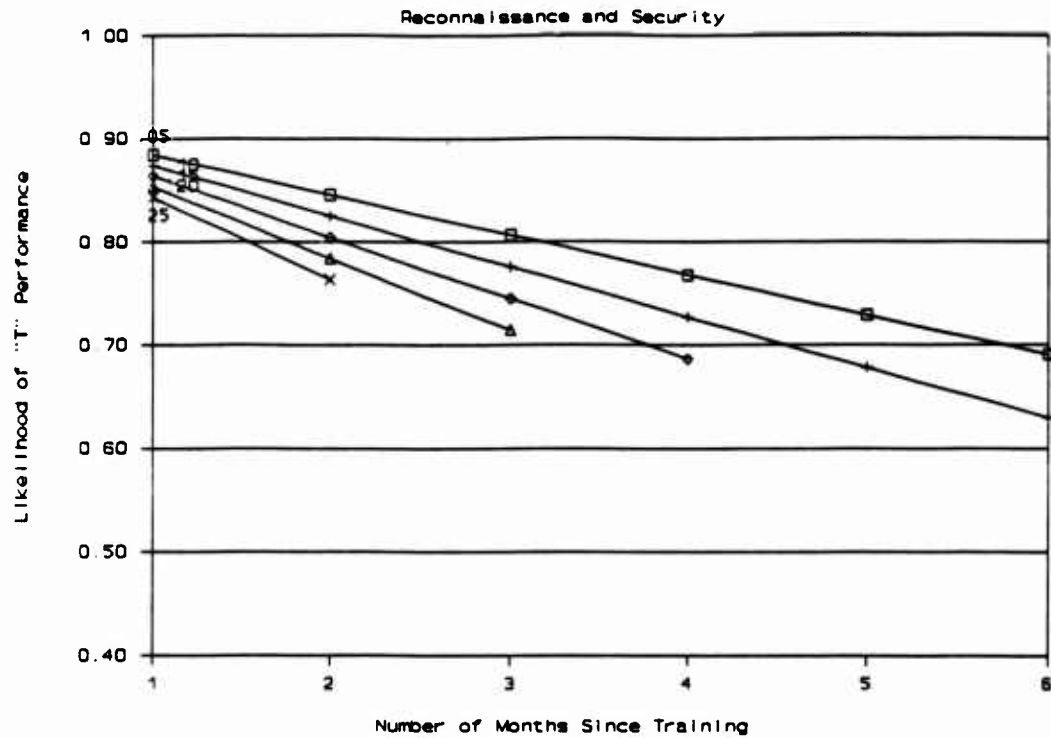
Mechanized Infantry Squad Tasks



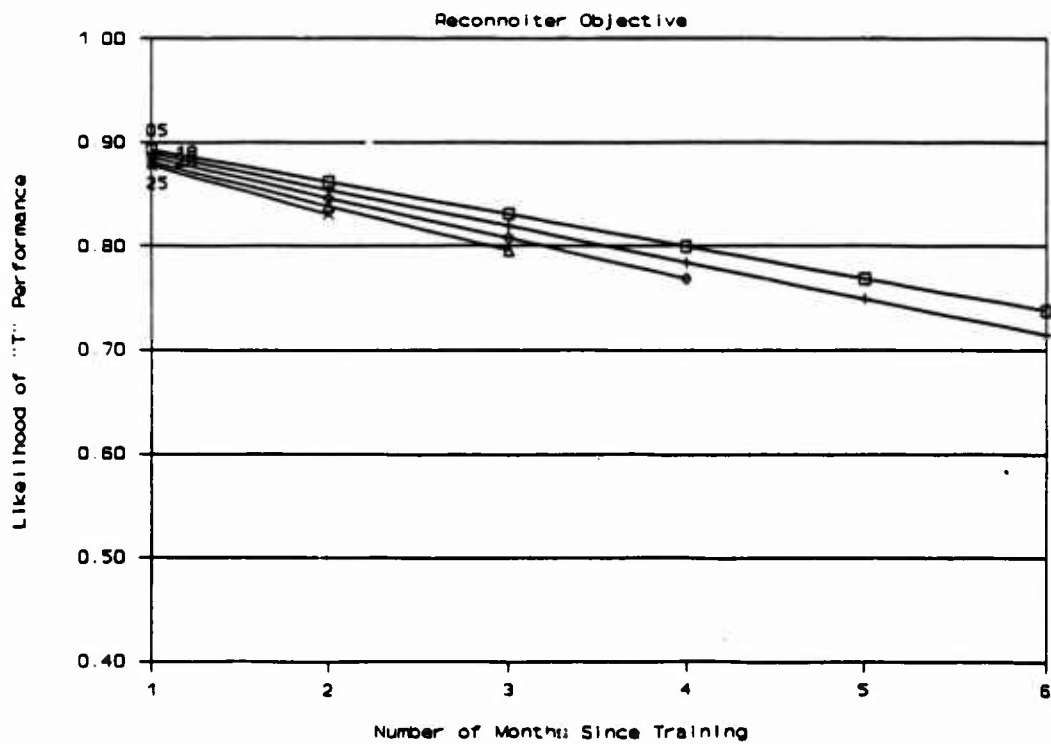
Mechanized Infantry Squad Tasks



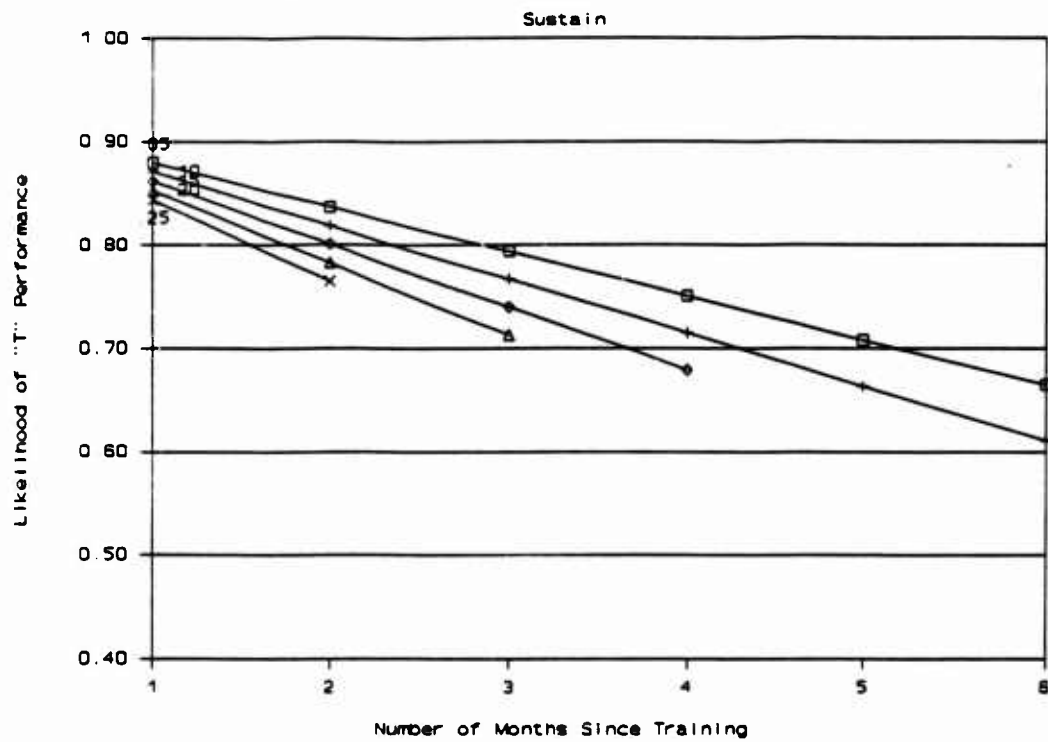
Mechanized Infantry Squad Tasks



Mechanized Infantry Squad Tasks



Mechanized Infantry Squad Tasks



Mechanized Infantry Squad Tasks

